

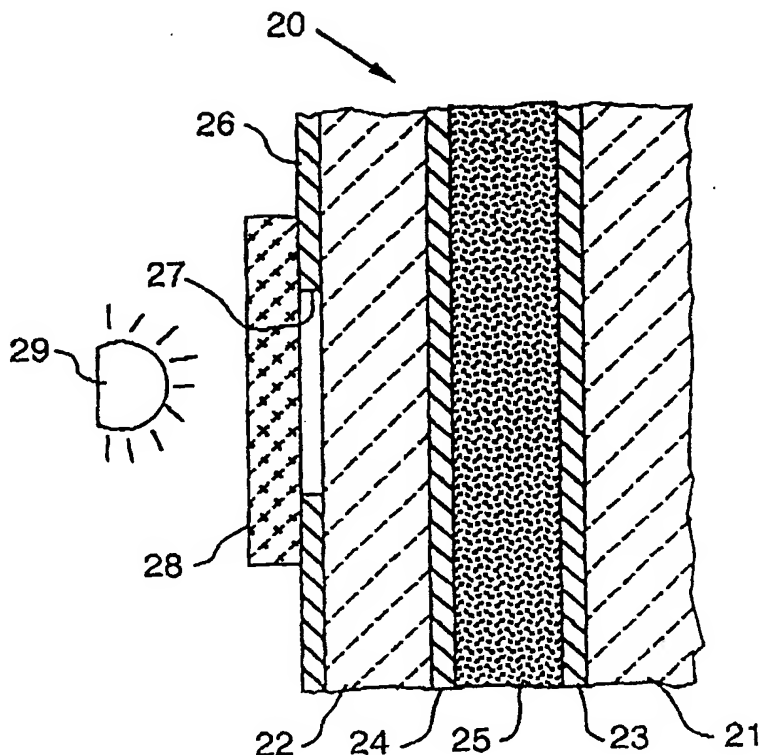
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : G02B 7/182		A1	(11) International Publication Number: WO 00/22471
			(43) International Publication Date: 20 April 2000 (20.04.00)
(21) International Application Number: PCT/US99/22938 (22) International Filing Date: 13 October 1999 (13.10.99) (30) Priority Data: 09/172,393 14 October 1998 (14.10.98) US 09/311,029 13 May 1999 (13.05.99) US (71) Applicant: GENTEX CORPORATION [US/US]; 600 North Centennial Street, Zeeland, MI 49464 (US). (72) Inventors: RUMSEY, Wayne, J.; 10660 Fawn View Court, Holland, MI 49424 (US). CARTER, John, W.; 2278 Woodlark Drive, Holland, MI 49424 (US). YPMA, Kenton, J.; 2654 Ridge Croft Drive, S.E., Grand Rapids, MI 49546 (US). NORTHMAN, Bradley, L.; 4899 Dunrobin Drive, N.E., Belmont, MI 49306 (US). BAUER, Frederick, T.; 236 Dyken Avenue, Holland, MI 49424 (US). DURNWALD, Mark, W.; 161 Tanglewood Drive, Holland, MI 49424 (US). (74) Agent: CARRIER, Robert, J.; Price, Heneveld, Cooper, Dewitt & Litton, 695 Kenmoor, S.E., P.O. Box 2567, Grand Rapids, MI 49501 (US).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published With international search report.	

(54) Title: REARVIEW MIRROR WITH DISPLAY

(57) Abstract

A mirror includes an electrochromic mirror subassembly (20) including front and rear transparent elements (21, 22), a layer of electrochromic material (25) associated with the front and rear transparent elements (21, 22), and a reflective layer (26), a portion of the reflective layer (26) defining an opening (27). An indicia panel (28) is located proximate the mirror subassembly (20) and covers the opening (27), and one or more light sources (29) are positioned to pass light through the indicia panel (28) and the opening (27) of the electrochromic mirror subassembly (20) to illuminate detailed symbols and information on the indicia panel (28). The indicia panel (28) is adhered to the mirror subassembly (20), and a housing and a mating bezel are configured to receive the mirror subassembly (20). A foam light seal is located between the printed circuit board and the indicia panel (28) and is shaped to sealingly engage the printed circuit board and the indicia panel (28) to prevent light leakage around the indicia panel (28).



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon	KR	Republic of Korea	PL	Poland		
CN	China	KZ	Kazakhstan	PT	Portugal		
CU	Cuba	LC	Saint Lucia	RO	Romania		
CZ	Czech Republic	LI	Liechtenstein	RU	Russian Federation		
DE	Germany	LK	Sri Lanka	SD	Sudan		
DK	Denmark	LR	Liberia	SE	Sweden		
EE	Estonia			SG	Singapore		

REARVIEW MIRROR WITH DISPLAY

FIELD OF THE INVENTION

The present invention relates to vehicle rearview mirrors, and more particularly related to the display of information on a rearview mirror assembly.

BACKGROUND OF THE INVENTION

Modern cars and trucks include rearview mirrors mounted inside and outside of the vehicle. One type of conventional interior rearview mirror comprises a prismatic mirror that can be switched from a first orientation suitable for normal driving conditions to a second orientation, which reduces glare caused by headlights of vehicles approaching from the rear.

Recently, electrochromic rearview mirrors have been developed which automatically change from a full reflectance mode during the day to a partial reflectance mode during the night for glare protection. Electrochromic rearview mirrors typically comprise a relatively thin electro-optic medium sandwiched and sealed between two glass elements. In most assemblies, when the electro-optic medium is electrically energized, it darkens and absorbs an increasing amount of light as the applied voltage is increased. When the electrical voltage is removed, the mirror returns to its clear state. Examples of such automatic rearview mirrors are disclosed in U.S. Patent Nos. 4,902,108; 4,917,477; 5,128,799; 5,202,787; 5,204,778; 5,278,693; 5,280,380; 5,282,077; 5,285,060; 5,294,376; 5,682,267; 5,689,370; 5,448,397; 5,451,822; and 5,818,625 each of which is assigned to the assignee of the present invention and each of which is incorporated herein by reference.

In the past, information such as the words "HEATED" or "OBJECTS IN MIRROR ARE CLOSER THAN THEY APPEAR" have been used on many vehicle rearview mirrors. In addition, some types of automatic rearview mirrors have included compass and temperature readings. However, such conventional rearview mirror displays typically comprise a glossy planar surface, which makes the display difficult to read. Furthermore, such conventional displays are often difficult or impossible to read by some occupants of a vehicle. For example, interior rearview mirrors are typically angled toward the driver and away from the front seat passenger, thereby obstructing the front seat passenger's ability to see the display. In addition, selectable information displays commonly used in automobile interiors comprise complex electronic assemblies. This type of display is not only expensive, but also more prone to failure due to the number and complexity of components.

5 In addition to the problems and concerns discussed above with displays on mirrors, there are additional problems that need to be addressed. One way of forming the individual letters of the words "HEATED" and "OBJECTS IN MIRROR . . ." is to apply reflector material to an electrochromic mirror subassembly as a uniform layer, and then selectively
10 remove portions of reflector material to form the shape or image of detailed alphanumeric and symbolic indicia in the reflector material. However, it is difficult to remove the reflector material in a manner that accurately and consistently forms all parts of small letters and symbols, such that the removal process potentially results in significant scrap. This scrap can be very expensive because, not only does a significant percentage of scrap
15 result from imperfect indicia images, but further the mirror subassembly is relatively expensive work-in-process at that point in the manufacturing process. Concurrently, the scrap is difficult to repair.

Another problem is that, even if reflector material is accurately removed to form the indicia image, many manufacturers want color in their displays to improve their
20 customer appeal. Colored translucent labels have been used in the past in vehicles, such as in instrument panels, to create visual displays. However, there are problems with known prior art labels used in the environment of a mirror. For example, stick-on labels using adhesive may partially delaminate from glass mirror element over time, leading to poor appearance where the released adhesive has a discontinuous and patchy appearance. Also,
25 the adhesive can trap air during the installation process, leading to immediate poor appearances or leading to in-service delamination problems as the stick-on label and its carrier are thermally cycled.

Alignment of components and displays in mirrors is another important consideration in regard to customer acceptance. Display information that is non-parallel and angled
30 relative to a perimeter of the mirror can result in a customer forming a very poor opinion of the quality of a vehicle, even though the mirror is fully functional. Further, misalignment can be very aggravating to a customer, because the customer sees the misalignment problem every time they look in the mirror, which occurs every time they are in the vehicle.

Another problem is accurate positioning and retention of a printed circuit board in the mirror housing. Printed circuit boards carry circuits used in electrochromic mirrors to control darkening for glare protection, and also carry other circuits and sensors, such as for daylight sensing, keyless entry signal sensing, information displays, and the like. It is

important that the printed circuit board be accurately positioned so that any light sources and sensors carried thereon are accurately located, and so that any control buttons for the mirror that are mounted on the printed circuit board and protrude through a face of the housing are also properly and accurately positioned. Additionally, it is noted that the printed circuit board should be firmly held in a manner preventing rattling, but in a manner not leading to breakage, fracturing, or undue bending or stressing of the printed circuit board during assembly and during thermal cycling while in service.

Another less obvious problem concerns secondary reflections and scattering of light within transparent layers in the mirror subassembly. Electrochromic mirror subassemblies include a pair of transparent elements, such as flat glass elements, with a chamber therebetween. The chamber is filled with electrochromic material that includes a first layer of transparent conductor material and either another layer of transparent conductor (if the mirror subassembly is a fourth surface reflector), or a reflector/electrode (if the mirror subassembly is a third surface reflector). When light is introduced through an opening in the reflector, a primary amount of the light travels through the transparent elements and through the associated layers of electrochromic material without unacceptable distortion. However, a small amount of the light is reflected as the light passes through each of the interfacing surfaces in the mirror subassembly. This can lead to double images (sometimes called "ghosting"), blurred images, shadowing, and/or the occurrence of undesirable scattering of light across a visible face of the mirror subassembly. This is undesirable because it reduces the clarity of the visual display and can, in extreme cases, be interpreted by a customer as a defect.

The present invention has been developed in view of the foregoing, and to address other deficiencies of the prior art.

SUMMARY OF THE PRESENT INVENTION

In one aspect of the present invention, a mirror includes a housing and an electrochromic mirror subassembly in the housing including front and rear transparent elements, a layer of electrochromic material associated with the front and rear transparent elements, and a reflector layer associated with the rear transparent element. A portion of the reflector layer defines an opening, and an indicia panel is provided that covers the opening and that is configured to form a visual display. A light source is positioned in the housing to pass light through the indicia panel and the opening of the electrochromic mirror subassembly to selectively illuminate the visual display.

In another aspect of the present invention, a mirror includes a mirror subassembly having at least one transparent element and a reflective layer, an indicia panel attached to the mirror subassembly, and a housing and a mating bezel configured to receive the mirror subassembly. The indicia panel includes at least one locating feature. At least one of the housing and the bezel includes a mating feature shaped to engage the at least one locating feature to accurately locate the indicia panel and the mirror subassembly in the housing.

In yet another aspect of the present invention, a mirror includes a housing and an electrochromic mirror subassembly in the housing having front and rear transparent elements, a layer of electrochromic material associated with the front and rear transparent elements, and a reflective layer. A portion of the reflective layer defines an opening, and an indicia panel covers the opening. A printed circuit board in the housing is spaced from the indicia panel, and a light source on the printed circuit board is positioned to pass light through the indicia panel and through the opening on the electrochromic mirror subassembly. A light seal is located between the printed circuit board and the indicia panel and is shaped to sealingly engage the printed circuit board and the indicia panel to prevent light leakage around the indicia panel.

In still another aspect of the present invention, a mirror includes an electrochromic mirror subassembly having front and rear transparent elements, a layer of electrochromic material associated with the front and rear transparent elements, and a reflective layer. An indicia panel is attached to a rear surface of the mirror subassembly. A printed circuit board is spaced from the indicia panel, and a light source on the printed circuit board is positioned to pass light through the indicia panel and the electrochromic mirror subassembly. A light seal is provided that is shaped to sealingly engage the printed circuit board and the indicia panel to prevent light leakage laterally from the indicia panel. A housing and a bezel are shaped to receive the mirror subassembly and, when assembled, shaped to compress together the mirror subassembly, the indicia panel, the printed circuit board, and the light seal.

These and other features, advantages, and aspects of the present invention will be further understood and appreciated by those skilled in the art by reference to the following specification, claims, and appended drawings.

DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic diagram of a vehicle sensor and display system in accordance with an embodiment of the present invention;

Fig. 2 is a front elevational view of a rearview mirror including a passenger air bag status display in accordance with an embodiment of the present invention;

Fig. 3 is a partially schematic, side-sectional view illustrating a rearview mirror display in accordance with an embodiment of the present invention;

5 Fig. 4 is a front elevational view of a rearview mirror including a non-planar display in accordance with another embodiment of the present invention;

Fig. 5 is a bottom view of the rearview mirror of Fig. 4;

Fig. 6 is a side view of the rearview mirror of Fig. 4;

10 Fig. 7 is a front elevational view of a rearview mirror including a non-planar display in accordance with a further embodiment of the present invention;

Fig. 8 is a bottom view of the rearview mirror of Fig. 7;

Fig. 9 is a front elevational view of a rearview mirror including a non-planar display in accordance with another embodiment of the present invention;

Fig. 10 is a top view of the rearview mirror of Fig. 9;

15 Fig. 11 is a front elevational view of a rearview mirror including a non-planar display in accordance with a further embodiment of the present invention;

Fig. 12 is a top view of the rearview mirror of Fig. 11;

Fig. 13 is a partially schematic, side-sectional view illustrating a rearview mirror display in accordance with an embodiment of the present invention;

20 Figs. 14 and 15 are front and bottom views of another embodiment of the present invention, including a particularly shaped indicia panel;

Fig. 16 is a cross section taken along the line XVI-XVI in Fig. 14;

Figs. 17 and 18 are front and rear exploded perspective views of the mirror shown in Fig. 14;

25 Fig. 19 is a front view of the indicia panel shown in Fig. 14;

Figs. 20 and 21 are rear and side views of the indicia panel shown in Fig. 19;

Fig. 22 is a cross section taken along the line XXII-XXII in Fig. 20;

Fig. 23 is an exploded perspective view of the indicia panel shown in Fig. 19;

30 Fig. 24 is a flow chart showing a manufacturing method for assembling the mirror shown in Fig. 14;

Fig. 25 is a schematic side cross section similar to Fig. 3, but showing undesirable secondary light reflections in the embodiment of Fig. 14; and

Fig. 26 is a schematic side cross section similar to Fig. 25, but showing an embodiment where the indicia panel is attached to a front of the mirror subassembly and under the front bezel.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

5 Fig. 1 is a schematic diagram illustrating a vehicle sensor and display system 1 in accordance with an embodiment of the present invention. The system 1 includes a passenger sensor 2, a passenger air bag controller 4, and a passenger air bag status display 6. Alternatively, the display system could include a manual air bag shutoff switch in place of, or in addition to, the passenger sensor 2 and the air bag controller 4.

10 The passenger sensor 2 is used to determine whether a passenger is located at a particular position in a vehicle. For example, the passenger sensor 2 may be used to determine whether a passenger is seated in the right front passenger seat of a car or the like. The passenger sensor 2 may be used to determine the approximate size of a passenger in order to allow deactivation of the passenger's air bag if the passenger is less than a particular size. The sensor 2 may also be used to determine whether an infant or child seat is present and to deactivate the air bag if such an infant or child seat is detected. Examples of suitable passenger sensors 2 include conventional infrared sensors, pressure sensors, and the like.

15 As shown in Fig. 1, the passenger sensor 2 is connected to the passenger air bag controller 4. Based on the signal provided by the passenger sensor 2, the controller 4 switches the passenger air bag on when a suitable size person is positioned in the passenger seat, and switches the air bag off when there is no passenger in the seat. Alternatively, the air bag status display 6 may be connected directly to the passenger sensor 2. Furthermore, the air bag display 6 may be connected to a manual air bag shutoff switch (not shown).
20 The passenger air bag controller 4 is connected to the passenger air bag status display 6, as schematically shown in Fig. 1.

25 In accordance with the present invention, the passenger air bag status display 6 is located on a rearview mirror assembly. The display 6 may include any suitable indicia which alerts occupants of the vehicle that the passenger air bag is either active or inactive. For example, the display 6 may illuminate the words "PASSENGER AIR BAG OFF" when the passenger air bag has been deactivated by the controller 4 or by a manual switch. Alternatively, the display 6 may include any other symbols and/or alphanumeric characters,
30

which adequately convey information concerning the status of the passenger air bag to at least one occupant of the vehicle.

In accordance with the preferred embodiment of the present invention, the display 6 is located on the interior rearview mirror assembly of a vehicle. Vehicle drivers generally look at the interior rearview mirror very frequently. This frequent use makes the interior rearview mirror an optimal location for the display of critical safety information, such as air bag status. By displaying safety information on the interior rearview mirror assembly, the driver or other occupants of the vehicle may be alerted to critical information, which could otherwise go unnoticed.

Examples of suitable displays include LED, vacuum-fluorescent, and LCD displays. The display may comprise a filter with words such as "AIR BAG," an air bag symbol displayed on a surface which would become visible, more apparent, or change color when the display is illuminated or backlighted, or an indicator light or series of lights in a location relative to a symbol or text indicative of an air bag, which would announce the activation or deactivation of the air bag system by a change of status or color of the light(s). These indicators and displays could be located on the assembly supporting and encasing the mirror, in a module supported by but not integral with the mirror assembly, or in the mirror surface, as more fully described below.

Fig. 2 is a front elevational view of a rearview mirror 10 in accordance with an embodiment of the present invention. The rearview mirror 10 includes a mirror surface 11 surrounded by a bezel 12. In the embodiment shown in Fig. 2, the rearview mirror 10 is an automatic interior electrochromic mirror. However, other types of rearview mirrors including exterior mirrors and prismatic interior mirrors may be provided in accordance with the present invention.

As shown in Fig. 2, a chin 13 is located at the bottom of the bezel 12. A switch 14 may be provided inside the chin 13 in order to turn the automatic electrochromic rearview mirror 10 on or off. A conventional light sensor 15 may be located in the chin 13 or at any other suitable location. In addition, an indicator 16 located in the chin 13 is used to indicate whether the electrochromic rearview mirror 10 is on or off. Typically, the indicator 16 includes a light, which is illuminated when the electrochromic rearview mirror 10 is on.

In the embodiment of Fig. 2, a passenger air bag status display 18 is located in the mirror surface 11. The display 18 includes the words "PASSENGER AIR BAG OFF."

However, any other suitable symbolic or alphanumeric indicia which adequately convey the status of the passenger air bag may be used.

In the case of the mirror surface display 18, any suitable display can be located in or behind the mirror for viewing through the mirror assembly. The display 18 may
5 comprise a substantially transparent section in the mirror. Part or the entire reflective surface may be removed from a selected area. An indicator light source is positioned behind the selected area. Removal of any other opaque elements in the aforementioned area are also desirable so that the indicator or display can be viewed through the mirror. The removal of the reflective surface could create an indicator graphic pattern where
10 desired. For example, the words "PASSENGER AIR BAG OFF" could be etched away from the reflective surface partially or completely to allow transmission of light from a light source through the graphic pattern to thereby indicate the status of the air bag system.

Fig. 3 is a partially schematic side sectional view showing one type of rearview mirror display assembly 20 that may be used in the rearview mirror 11 of Fig. 2. The
15 rearview mirror display assembly 20 includes a first glass sheet 21 which forms a viewing surface facing the occupant of a vehicle. The viewing surface of the first glass sheet 21 may be smooth or may be provided with a matte texture. A second glass sheet 22 is spaced from the first glass sheet 21. A substantially transparent, electrically conductive layer 23 covers the interior side of the first glass sheet 21, while another substantially transparent,
20 electrically conductive layer 24 covers the interior of the second glass sheet 22. An electrochromic composition 25 fills the gap between the glass sheets 21 and 22. A reflective layer 26 made of any suitable material, such as silver, is provided on the surface of the second glass sheet 22. The display assembly 20 is thus provided as a part of an electrochromic rearview mirror. The various components of the electrochromic rearview
25 mirror may be arranged and constructed as disclosed in the previously cited U.S. patents incorporated herein by reference.

As shown in Fig. 3, a portion of the reflective layer 26 is removed from the glass sheet 22 in order to provide an opening 27. An indicia panel 28 covers the opening 27. A
30 light source 29 is arranged such that upon illumination, light travels through the indicia panel 28, opening 27, and the remaining layers 21-25 of the electrochromic mirror assembly toward the occupant of the vehicle. The indicia panel 28 may be unmarked or may comprise any desired indicia, such as alphanumeric symbols or the like. The indicia panel 28 may optionally comprise a color filter. The light source 29 may comprise any

suitable type of illuminator, such as an LED, LCD, vacuum-fluorescent element, incandescent light, or the like.

5 The display 18 may thus be part of the silver coating that is etched/removed to form the individual letters or components of the graphics through which the light would pass to illuminate the lettering or graphics. The display 18 may further comprise lettering or graphics printed or otherwise applied to a cleared area in the silver where the graphics or lettering would be of a design to show contrast when illuminated. The graphics or display can be separate from the mirror element mounted behind the element, such as a conventional LCD display, a vacuum-fluorescent display, a static mask through which light
10 will pass to display graphics or lettering, or other display types.

A color filter may optionally be included between the display light source and the viewer, such as a color filter printed or bonded to the mirror surface, or a filter installed on the light source, or at any point therebetween. The light source could also be of a bandwidth narrower than full-spectrum visible light for the purpose of displaying a
15 distinctive color through the display graphics to indicate the status of the air bag system.

In versions requiring removal of some of the silver surface, a portion rather than all of the silver can be removed in an area and still allow the display to be seen. One method is to remove a pattern, such as a grid. This allows conduction across a substantial amount of the surface facilitating coloring and clearing of the electrochromic substance in that area
20 proportional to the rest of the element. Another method is to allow breaks in letters and graphics to avoid closed islands in the surface.

In the embodiment of Fig. 2, the surface of the display 18 is flush with the surface of the mirror 11. Alternatively, the surface of the display 18 may be non-planar. For example, the surface of the display 18 may comprise a convex arc extending from the
25 surface of the mirror 11.

In accordance with a preferred embodiment of the present invention, a non-planar display is provided on a rearview mirror assembly. As used herein, the term "non-planar display" means a display having a contoured exterior viewing surface instead of a flat exterior surface. Preferred non-planar contoured display surfaces include curved or faceted
30 convex configurations.

Figs. 4-6 illustrate a rearview mirror 30 having a non-planar display in accordance with a preferred embodiment of the present invention. The rearview mirror 30 is an automatic electrochromic mirror including a mirror surface 31 and a bezel 32. Although an

electrochromic mirror is shown in Figs. 4-6, other types of mirrors, such as prismatic rearview mirrors, are within the scope of the present invention. A contoured chin 33 having a curved front face is located at the bottom of the bezel 32. The contoured chin 33 houses a compass switch 34, a mirror switch 35, a light sensor 36, and an on/off indicator 37. In this embodiment, a non-planar display 38 is located in the chin 33. As shown most clearly in Fig. 5, the surface of the non-planar display 38 is convex and conforms to the contoured surface of the chin 33.

The use of a convex non-planar display 38 provides substantially improved viewability of the information provided by the display. The curved exterior surface of the display 38 essentially prevents unwanted glare from surrounding light sources and provides improved viewability to occupants of the vehicle. For example, both the driver and front passenger(s) of the vehicle can readily see the information provided by the display 38 without obstruction. In a preferred embodiment, the non-planar surface of the display 38 has a matte texture in order to further reduce unwanted glare.

A display, such as a vacuum-fluorescent, LCD, LED, or the like, may be mounted in the bezel or, preferably, behind a filter in the bezel. A static display may simply be illuminated or the illumination color changed to display information. This display offers several possible configurations. A preferred display comprises an opening in the bezel and a mask or label with graphics and/or lettering printed onto the surface to allow light to pass through the lettering or graphics portion of the label. Lettering or graphics molded or embossed into the bezel through which light could pass to illuminate the lettering or graphics may be used. A translucent bezel or portion of the bezel on which the graphics could be painted or printed to allow light to pass through only select parts may also be used. Furthermore, printed or molded graphics or lettering with a corresponding translucent or open section through which light could pass to indicate status may be used. In addition, a status display of graphics and/or lettering with a corresponding light which illuminates or changes color may be used.

In the embodiment shown in Figs. 4-6, the rearview mirror 30 includes a compass reading 39, which indicates the direction in which the vehicle is oriented. The compass switch 34 may be used to turn the compass reading 39 on and off. As shown most clearly in Figs. 5 and 6, the rearview mirror 30 includes a housing 41 and a conventional mounting bracket 42. However, other mounting methods can be used.

Figs. 7 and 8 illustrate a rearview mirror 50 in accordance with another embodiment of the present invention. The electrochromic rearview mirror 50 includes a mirror surface 51 and a surrounding bezel 52. A chin 53 having a generally planar front face extends from the bottom of the bezel 52. The chin 53 houses a compass switch 54, a mirror switch 55, a light sensor 56, and an on/off indicator 57. A convex non-planar display 58 extends from the surface of the chin 53. A compass display window 59 is provided in the mirror surface 51. The rearview mirror 51 also includes a housing 61. The convex surface of the non-planar display 58 shown in Figs. 7 and 8 substantially improves visibility of the displayed message.

Figs. 9 and 10 illustrate a rearview mirror 70 in accordance with a further embodiment of the present invention. The electrochromic rearview mirror 70 includes a mirror surface 71 surrounded by a bezel 72. A chin 73 located at the bottom of the bezel 72 includes a mirror switch 74, a light sensor 75, and an on/off mirror indicator 76. A crown 77 having a substantially planar front surface is located at the top of the bezel 72. A convex non-planar display 78 is located in the crown 77. The rearview mirror 70 also includes a housing 81.

Figs. 11 and 12 illustrate another rearview mirror 90 in accordance with a further embodiment of the present invention. The rearview mirror 90 includes a mirror surface 91 surrounded by a bezel 92. A chin 93 located at the bottom of the bezel 92 houses a mirror switch 94, a light sensor 95, and an on/off mirror indicator 96. The right side of the bezel 92 includes an extension 97 having a non-planar display 98 therein. The rearview mirror 90 comprises a housing 99. In this embodiment, the non-planar display 98 is oriented such that a passenger seated in the front right seat of a vehicle can easily see whether the passenger air bag is on or off.

Fig. 13 is a partially schematic side sectional view illustrating a rearview mirror non-planar display assembly 100 in accordance with an embodiment of the present invention. The non-planar display assembly 100 includes an electrochromic mirror assembly comprising a first glass sheet 101, a second glass sheet 102 spaced from the first glass sheet 101, and an electrochromic material 103 filling the gap between the glass sheets 101 and 102. A seal 104 extends between the glass sheets 101 and 102 in order to retain the electrochromic material 103 therebetween. Although not shown in Fig. 13, the electrochromic mirror assembly may include substantially transparent electrically conductive films on the interior surfaces of the glass sheets 101 and 102, and may comprise

a reflective mirror surface positioned at any suitable location, such as the exterior surface of the second glass sheet 102. Suitable types of electrochromic rearview mirror assemblies are disclosed in the previously cited U.S. patents which are incorporated herein by reference.

5 As shown in Fig. 13, a bezel 105 contacts the exterior viewing surface of the first glass sheet 101 of the electrochromic mirror assembly. A lamp holder 106 having a reflective interior surface is formed in the bezel 105. A light source assembly 107 is secured in the lamp holder 106. In the embodiment shown in Fig. 13, an LED 108 is provided as part of the light source assembly 107. Alternatively, any other suitable light
10 source, such as an electroluminescent source, incandescent light, or the like, may be used. An indicia panel 109 covers the lamp holder 106. The indicia panel 109 forms the exterior viewing surface of the display. In accordance with the preferred embodiment of the present invention, the indicia panel 109 comprises a convex exterior viewing surface defined by at least one radius of curvature, as more fully described below.

15 The indicia panel 109 shown in Fig. 13 may be unmarked or may comprise any desired graphics, alphanumeric symbols, or the like. The indicia panel 109 may optionally include a color filter.

Preferred non-planar displays of the present invention comprise a convex exterior viewing surface defined by at least one radius of curvature. The radius of curvature may
20 be constant or may vary along the exterior surface of the display. For example, in the embodiments shown in Figs. 4-10, the non-planar displays have an exterior curved surface of substantially constant radius defined by an arc swept around a substantially vertical axis. Such arcs are most readily seen in Fig. 8, element 58 and in Fig. 10, element 78. The radius of the arc typically ranges from about 1 cm to about 60 cm, and more preferably
25 from about 1.5 cm to about 15 cm. This geometry results in a display that is readily viewed by all occupants of the vehicle while reducing unwanted glare.

In the embodiments of Figs. 11 and 12, the non-planar display has a varying radius of curvature, which substantially conforms to the curved bezel surface of the mirror. The non-planar display reduces glare and is readily viewable to at least the right front passenger
30 of the vehicle.

Conventional planar displays have a high degree of first surface reflection, which decreases the contrast between the graphics of the display which are intended to be viewed and the reflected light from the surface. This degrades the ability for a passenger to view

the displayed information, since the front seat passenger is usually seated in a position which can create a viewing angle up to 30 degrees or more off of perpendicular to the mirror front surface. A non-planar display, as well as surface treatment such as a matte finish to decrease the reflection of the surface, increases the contrast of the display, especially when viewed at an angle. The curvature of the display also serves to orient the display or a portion of the display toward the passenger and, therefore, improve the visibility of the display. A low-glare surface and a convex surface have the added benefit of reducing glare on the display surface for the driver and other occupants of the vehicle. Additionally, since the display surface is typically at the same angle as the mirror surface, glare from the headlamps of a following vehicle can also render a glossy, planar display unreadable.

Although the non-planar displays described in the specific embodiments herein are used to convey information concerning the status of a passenger air bag, other types of symbolic or alphanumeric information may be displayed on rearview mirror assemblies in accordance with the present invention. For example, the status of other air bags or supplemental restraint systems in the vehicle may be displayed. Furthermore, information such as door ajar, fasten seat belts, fuel mileage, time, temperature, heading, altitude, and the like may be displayed.

MODIFICATION

A mirror assembly 115 (also referred to herein as "mirror 115" herein) (Figs. 14 and 15) includes a housing 116 and a bezel 117 defining a cavity 118, and further includes an electrochromic mirror subassembly 120 (Fig. 25) supported in the cavity 118 along with a printed circuit board 119. The printed circuit board 119 has a circuit thereon that is configured to operate the electrochromic mirror subassembly 120 for controlled darkening to reduce glare in the mirror 115. An indicia panel 130 (sometimes called an "applique") is attached to a rear of the mirror subassembly 120 or bezel 117 to provide a low cost, highly attractive lighted display on the mirror 115. The indicia panel 130 is constructed to be exceptionally attractive and effective, as described below. The indicia panel 130 is constructed with locator-engaging details that facilitate its alignment on the mirror subassembly 120, and further that provide alignment of the mirror subassembly 120 on the bezel 117 and in the housing 116, as also disclosed below.

The illustrated electrochromic mirror subassembly 120 is commonly referred to as a fourth surface reflector, but it is contemplated that the present invention will work well

with third surface reflectors and with other mirror constructions. Accordingly, it is contemplated that a scope of the present invention includes all such mirror constructions and the present description should not be construed as unnecessarily limiting. The illustrated mirror subassembly 120 (Fig. 25) includes front and rear transparent elements 121 and 122 (*e.g.*, glass), electrically conductive layers 123 and 124 on inner surfaces of the transparent elements 121 and 122, respectively, a layer of electrochromic material 125 located between the conductive layers 123 and 124, and a reflective layer 126 on a rear surface of the rear transparent element 122 (*i.e.*, the "fourth" surface of the mirror subassembly 120). A seal 125' extends around an inside perimeter of the transparent elements 121 and 122 to retain the electrochromic material 125, when the electrochromic material 125 is a liquid-phase type, or gel-phase type, or a hybrid of same. (It is noted that a perimeter edge striping may be applied to transparent elements 121 and 122 for aesthetics, which results in a similar appearance.) A portion of the reflective layer 126 is etched away or otherwise removed to define an elongated opening 127 (Fig. 18). The indicia panel 130 is adhered to the reflector layer 126 in a location 130' where it covers the opening 127. Light sources 129 are positioned behind the indicia panel 130 to pass light through the indicia panel 130 and through the opening 127 of the electrochromic mirror subassembly 120 to selectively illuminate detailed symbols and information on the indicia panel 130 for viewing by a vehicle driver or passengers. A foam light seal 134 on the indicia panel 130 is located between the printed circuit board 119 and the indicia panel 130, and is shaped (see Fig. 16) to sealingly engage the printed circuit board 119 and the indicia panel 130 to prevent light leakage around the indicia panel 130. Specifically, the foam light seal 134 defines multiple windows 146'-148' (Fig. 23) engaging the indicia panel 130 for containing light from each of the light sources 129 (Fig. 17) as each window area is illuminated. The housing 116 and the bezel 117 snap together and are shaped to compress together the mirror subassembly 120, the indicia panel 130, the printed circuit board 119, and the light seal 134, thus compressing the light seal 134 to assure good contact by the light seal 134.

It is contemplated that the present invention includes many different indicia panels constructed with light-absorbing material to absorb undesired stray light and reflections, and also constructed with locator tabs and locator features. The illustrated indicia panel 130 (Fig. 23) includes a body panel 140 of light-passing translucent or transparent material, such as a mylar sheet, having a rectangular main section 141 and down-angled tabs 142 at

each end. The body panel 140 includes a front surface treated to minimize the degree to which it will show fingerprints, as known in the art. A locating feature or locator hole 143 is formed in each tab 142. The holes 143 are configured to engage locator protrusions on a fixture (not specifically shown, but see Fig. 23) for providing very accurate alignment of the indicia panel 130 on the mirror subassembly 120 when the indicia panel 130 is adhered to a rear surface of the mirror subassembly 120. The locator holes 143 are further configured to engage a pair of locator protrusions 170 on the bezel 117 to very accurately locate the mirror subassembly 120 (including the indicia panel 130) in the bezel 117 and mirror housing 116, as described below. When adhesive layer 55 is eliminated, the locator holes engage the protrusions 170 for alignment of the indicia panel 130, while other structure on the housing 116 and bezel 117 align the mirror subassembly 120.

A light-absorbing layer 145 of ink, film, paint, or the like is applied to a back surface of the body panel 140. The light-absorbing layer 145 accurately forms relatively small and well-defined windows 146-148 on the body panel 140. One or more layers of semitransparent or translucent material 149-153 are applied onto the body panel 140 in the area of windows 146-148 to form the indicia of the present visual display. It is contemplated that the materials 149-153 have properties allowing them to be accurately applied to form detailed symbols, such as by known printing and symbol forming, film applying processes. For example, it is contemplated that the ink could be applied by a multi-coating printing process, or even by an ink-jet printer or copying/duplicating machine. The illustrated black material 149 includes apertures that form clear lettering. The layer 150 is applied behind the clear lettering and is translucent white, such that the words "PASSENGER AIR BAG" appear when the window 146 is luminated. The material 151 is also white and shows through as a symbol of a person with an air bag inflated in front of the person, but it is contemplated that the material 151 could of course be colored (*e.g.*, orange or red) to highlight and distinguish the symbol. The materials 152 and 153 form letters for the words "on" and "off," which are visible only when the individual window 147 or window 148 are luminated.

In the illustrated indicia panel 130, an elongated layer 155 (Fig. 23) of adhesive having a small vertical dimension is applied to a face of the body panel 140 along an upper edge above the windows 146-148, with ends of the layer 155 extending partially downwardly along an upper edge of the down-angled tabs 142 to form a concavely shaped adhering area on three sides of the indicia forming the visible display. This concave

arrangement helps avoid trapping air when adhering the indicia panel 130 to the mirror subassembly 120. It also helps reduce thermal expansion problems by providing an area in which the body panel 140 can expand or flex. The adhesive layer 155 is covered with a release paper 156 to protect the adhesive during shipping and handling prior to assembly.

5 Seal 134 (Fig. 23) includes a piece of compressible foam 157 and further includes an adhesive-covered face 158 that adheringly attaches to a back of the light-absorbing layer 145 on the body panel 140 of the indicia panel 130. The compressible foam 157 has windows 146'-148' cut into the foam that align with the windows 146-148 in the light-absorbing layer 145.

10 The bezel 117 (Figs. 17 and 18) is generally oval shaped and configured to surround and mateably receivingly engage a perimeter of the mirror subassembly 120. A lower horizontal section (Fig. 16) of the bezel 117 includes upper and lower portions 161 and 162 that form a window for receiving finger-actuable switches or buttons 160 on the mirror 115. That portion of the bezel 117 that engages the perimeter of the mirror subassembly 120 includes a rearwardly extending inside section 163 that engages a face of the front transparent element 121, an aesthetically shaped front or transition area 164, and a rearwardly extending outer side section 165 that extends at least to a position adjacent an edge of the mirror subassembly 120. That portion of the bezel 117 that engages the housing 116 includes a rearwardly extending leg or flange 166 defining an outwardly facing cavity 167. The housing 116 includes a forwardly extending section 168 that fits into the cavity 167 and overlappingly engages the leg 166. The bezel 117 includes a hook-shaped connector 169 (Fig. 17) that is constructed to frictionally snap attach into a recess 169' in the housing 116. Guide fingers 169'' extend from housing 116 at locations adjacent the hook-shaped connectors 169. The fingers 169'' are shaped to engage a back surface of the flange 166 in a manner that forces the hook-shaped connector 169 into secure engagement with the recess 169'. It is contemplated that the hook-shaped connector 169 and the recess 169' can be reversed on the housing 116 and the bezel 117, or that they can be replaced with other connection means, such as screws, mechanical fasteners, adhesive, sonic welding, and the like.

20 25 30 The bezel 117 (Fig. 18) includes a pair of rearwardly protruding locator protrusions 170 spaced on either side of the indicia panel 130. The protrusions 170 are shaped to engage the holes 143 on the tabs 142 to accurately locate the indicia panel 130 relative to the bezel 117. This is very important because the indicia (*i.e.*, the lettering and symbols)

on the indicia panel 130 must be very accurately aligned with the bezel 117 to avoid the appearance of misalignment and poor quality. Since the indicia panel 130 is accurately adhered to the mirror subassembly 120, the protrusions 170 cause the mirror subassembly 120 (including the visible interior of the seal 134) to also be accurately aligned with the bezel 117.

Notably, it is specifically contemplated that adhesive layer 155 can be eliminated. In such case, the protrusions 170 accurately locate the indicia panel 130, while ribs and other structure of the housing 116 and bezel 117 accurately locate the mirror subassembly 120.

The printed circuit board 119 (Fig. 18) includes locator apertures or holes 173 that also engage the protrusions 170 to accurately locate the printed circuit board 119. The illustrated light sources 129, which can be any suitable type of illuminator, such as LED, LCD, vacuum-fluorescent elements, incandescent lights, or the like, are mounted to the printed circuit board 119. Nonetheless, it is contemplated that the light sources 129 could be mounted behind the printed circuit board 119 and shine through windows in the printed circuit board 119. Switches 160 are also mounted to the printed circuit board 119 in a position where they align with lower windows in the bezel 117, and where they are easy to operate by a seated driver.

The housing 116 (Fig. 17) includes sidewalls 176 having the recesses 169' and guide fingers 169'' that receive the hook-shaped connectors 169, and further include a back wall 177. The back wall 177 includes mounting structure 178 for operably adjustably engaging the vehicle ball mount 179 (Fig. 15). Projections 180 (Fig. 16) extend forwardly from the back wall 177 into abutting engagement with the printed circuit board 119. When assembled, the bezel 117 snap attaches to the housing 116 to compress together the mirror subassembly 120, the indicia panel 130, the printed circuit board 119, and the light seal 134 in a compressed sandwich-like arrangement, with the light seal 134 lightly compressed.

As shown by Fig. 24, the method of assembly includes printing and forming the indicia panel 130 in a step 183, and then adhering the foam light seal 134 to the indicia panel 130 in a step 184. In a step 185, the mirror subassembly 120 is fixtured by fixtured engagement of its locator holes 143, and the indicia panel 130 is accurately attached to the mirror subassembly 120 (if adhesive is used) by removing the release paper 156 and by adhering the adhesive 155 to a rear surface of the rear transparent element 122 as the indicia panel 130 is accurately held. The indicia panel 130 is then used to accurately locate

the mirror subassembly 120 to the bezel 117 by registering the holes 143 on the protrusions 170 of the bezel 117 in a step 186. Alternatively, where adhesive layer 155 is eliminated, protrusions 170 engage holes 143 to locate the indicia panel 130, but the mirror subassembly 120 is located by engagement with the bezel 117 and housing 116. The printed circuit board 119 is also accurately located by registering its holes 173 on the protrusions 170 in a step 187. The housing 116 is snap attached to the bezel 117 in step 188. This causes the abutting projections 180 on the housing 116 to engage the printed circuit board 119, compressing the foam light seal 134 between the printed circuit board 119 and the indicia panel 130, and compressing the indicia panel 130 with light pressure against the mirror subassembly 120. This light pressure helps hold the indicia panel 130 against the mirror subassembly 120, yet permits dimensional variation during assembly. This arrangement also allows the expansion and contraction that occurs during thermal cycling of the mirror 115 while in service.

One important benefit of using a light-absorbing indicia panel 130 is shown in Fig. 25. The light source 129 emits light 190, a primary portion 191 of which travels through the indicia panel 130, through the opening 127, and out through various components of the mirror subassembly 120 to a viewing person. Secondary reflections 192-196 occur at a rear surface of the rear transparent element 122, and at each interface between the layers 122/124, 124/125, 125/123, and 123/121. These secondary reflections 192-195 are absorbed by the light-absorbing layer 145 on the indicia panel 130. This arrangement greatly reduces unwanted stray light. The size of each window 146-148 and windows 146'-148' (see Figs. 16-18 and 23), and also the size of the opening 127 (Fig. 25), are chosen to optimize the clarity of the image projected by primary light portion 191 without detracting from the reflected images of the mirror 115. In a preferred form, the vertical dimension of the letters and symbols is about 25 percent to about 75 percent, or more preferably about 50 percent, of the vertical dimension of the opening 127.

It is noted that mirror subassemblies 120 having the same size opening 127 can be used in mirrors 115 having different options. For example, a different indicia panel 130 can be used along with different printed circuits boards 119, while still using the same bezel 117, housing 116, and mirror subassembly 120. This greatly facilitates manufacturing high volumes of mirror subassemblies 120 while still allowing for a maximum of options. Further, the same housing 116 and mirror subassembly 120 can be used, while using a different bezel 117. This is an important advantage since the mirror subassembly 120 is

one of the more expensive components of the mirror 115. It is important to have the mirror subassembly 120 be at a higher volume to optimize automation of the manufacturing process and to minimize costs.

5 It is specifically contemplated that aspects of the present invention can be utilized advantageously in different mirror constructions. One such mirror is illustrated in Fig. 26, and includes a front-mounted indicia panel 130A adheringly attached to a front surface of the front transparent element 121A. In mirror 115A, components and features that are identical or similar to the features and components of mirror 115 are identified by the same number, but with the addition of the letter A.

10 In mirror 115A, the indicia panel 130A is adhered to the front surface using adhesive 155A, and the light-absorbing layer 145A is located adjacent the adhesive 155A. Notably, it is contemplated that the adhesive 145A could be omitted where the indicia panel 130A is adequately supported by portions of the bezel 117A. It is also contemplated that the light-absorbing layer 145A could be positioned on the other side of the indicia panel
15 130A or even on any of the front or rear surfaces of the transparent elements 121A and 122A. The indicia panel 130A provides many of the advantages noted above, including fixturing advantages, good appearance, low cost, and a flexible part that can be used in mirrors having different options.

20 In the foregoing description, it will be readily appreciated by those skilled in the art that modifications may be made to the invention without departing from the concepts disclosed herein. Such modifications are to be considered as included in the following claims, unless these claims by their language expressly state otherwise.

The invention claimed is:

1. A mirror comprising:

a housing;

an electrochromic mirror subassembly in the housing including front and rear transparent elements, a layer of electrochromic material associated with the front and rear transparent elements, and a reflector layer associated with the rear transparent element, a portion of the reflector layer defining an opening;

an indicia panel covering the opening and configured to form a visual display; and

a light source positioned in the housing to pass light through the indicia panel and the opening of the electrochromic mirror subassembly to selectively illuminate the visual display.

2. The mirror defined in claim 1, wherein the indicia panel is adhered to the mirror subassembly.

3. The mirror defined in claim 2, wherein the opening is bounded on all sides by marginal material in the reflector layer.

4. The mirror defined in claim 3, wherein the reflector layer characteristically includes a section that is removed to form the opening.

5. The mirror defined in claim 4, wherein the indicia panel includes an adhesive layer bonding the indicia panel to one of the reflector layer and the rear transparent element.

6. The mirror defined in claim 5, wherein the reflector layer is located on a rear surface of the rear transparent element.

7. The mirror defined in claim 1, wherein the indicia panel includes a layer of light-absorbing material.

8. The mirror defined in claim 7, wherein the light-absorbing material forms a window smaller than the opening in the reflector.

9. The mirror defined in claim 7, wherein the light-absorbing material is black in color and non-glossy.

5 10. The mirror defined in claim 1, wherein the indicia panel includes a layer of symbol forming material suitable to repeatably and accurately form defect-free, detailed alphanumeric and symbolic indicia on the indicia panel.

10 11. The mirror defined in claim 10, wherein the indicia include different areas of white and black material.

12. The mirror defined in claim 10, wherein the indicia include areas of colored material.

15 13. The mirror defined in claim 1, wherein the indicia panel has tabs with at least one locating feature thereon suitable for use to accurately locate the indicia panel during assembly of the indicia panel to the mirror subassembly.

20 14. The mirror defined in claim 13, wherein the tabs extend downwardly below the rear transparent element.

25 15. The mirror defined in claim 14, wherein the at least one locating feature comprises a pair of holes.

30 16. The mirror defined in claim 1, including a bezel mateably engaging the housing and shaped to retain the mirror subassembly, at least one of the housing and the bezel including a locator, and wherein the indicia panel includes a locating feature engaging the locator to accurately locate the indicia panel relative to the bezel.

17. The mirror defined in claim 16, wherein the locating feature comprises a hole and the locator comprises a protrusion engaging the hole.

18. The mirror defined in claim 17, wherein the bezel includes the first-mentioned protrusion and also includes a second protrusion, and wherein the indicia panel includes a second hole engaging the second protrusion.

5 19. The mirror defined in claim 18, wherein the indicia panel is adhered to the mirror subassembly and wherein the first-mentioned and second protrusions engage the first-mentioned and second holes to locate the mirror subassembly and the indicia panel as a unit on the bezel.

10 20. The mirror defined in claim 19, including a printed circuit board positioned in the housing, the printed circuit board including a pair of locating apertures that engage the first-mentioned and second protrusions to locate the printed circuit board relative to the bezel and to the indicia panel.

15 21. The mirror defined in claim 20, wherein the housing includes abutment structure engaging the printed circuit board, such that the housing, the printed circuit board, the indicia panel, the mirror subassembly, and the bezel form a compressed sandwich-like arrangement upon assembly.

20 22. The mirror defined in claim 21, including a foam light seal located between the printed circuit board and the indicia panel, the indicia panel including marginal material that is compressed and that engages the indicia panel at a location generally aligned with a perimeter of the opening.

25 23. The mirror defined in claim 1, including a foam light seal carried by the indicia panel that is configured to seal around the opening to reduce stray light emitted by the light source.

30 24. The mirror defined in claim 23, wherein the opening is elongated, and the light seal is configured to seal around the opening.

25. The mirror defined in claim 24, wherein opening is at least about 50 percent larger than a height of indicia on the indicia panel, the indicia forming the visual display.

26. The mirror defined in claim 1, wherein the indicia panel includes multiple layers of covering material, at least one layer of which comprises a highly light-absorbing material and at least another layer of which is colored and translucent for letting light pass therethrough to form the visible display.

27. The mirror defined in claim 1, including a printed circuit board attached to the mirror subassembly, the printed circuit board having a circuit thereon that includes the first-mentioned light source and that further includes additional light sources thereon arranged to selectively illuminate different areas on the indicia panel.

28. The mirror defined in claim 27, including a light seal adhered to the indicia panel and shaped to seal around the different areas so that, when the first-mentioned and additional light sources are selectively lighted, only the selected different area is illuminated and not adjacent ones of the different areas.

29. The mirror defined in claim 28, wherein the printed circuit board includes at least one switch thereon, and including a bezel engaging the housing to hold the mirror subassembly, the bezel including at least one window shaped and positioned to receive the at least one switch.

30. A mirror comprising:

a mirror subassembly including at least one transparent element and a reflective layer;

an indicia panel attached to the mirror subassembly and having at least one locating feature; and

a housing and a mating bezel configured to receive the mirror subassembly, at least one of the housing and the bezel including a mating feature shaped to engage the at least one locating feature to accurately locate the indicia panel and the mirror subassembly in the housing.

31. The mirror defined in claim 30, wherein a portion of the reflective layer defines an opening, and including a light source positioned to pass light through the indicia panel and the opening of the mirror subassembly.

5 32. The mirror defined in claim 30, wherein the indicia panel is adhered to the mirror subassembly.

10 33. The mirror defined in claim 30, wherein the at least one locating feature on the indicia panel includes a locator hole, and wherein the mating feature on one of the housing and the bezel includes a locator protrusion that accurately engages the locator hole to locate the mirror subassembly on the housing and the bezel.

34. The mirror defined in claim 33, wherein the protrusion is located on the bezel.

15 35. The mirror defined in claim 34, wherein the indicia panel includes down tabs having the at least one locating feature thereon.

20 36. The mirror defined in claim 30, wherein the mating feature includes first and second locator protrusions, and wherein the at least one locating feature includes first and second locator holes engaging the first and second locator protrusions.

37. The mirror defined in claim 30, wherein the indicia panel includes adhesive adhering the indicia panel to the mirror subassembly.

25 38. The mirror defined in claim 37, wherein the indicia panel includes indicia printed thereon, and wherein the adhesive defines an area that extends around multiple sides of the indicia, but characteristically does not extend completely around the indicia.

30 39. The mirror defined in claim 30, wherein the bezel is configured to compress the indicia panel against the mirror subassembly.

40. A mirror comprising:
a housing;

an electrochromic mirror subassembly in the housing including front and rear transparent elements, a layer of electrochromic material associated with the front and rear transparent elements, and a reflective layer, a portion of the reflective layer defining an opening;

- 5 an indicia panel covering the opening;
- a printed circuit board in the housing and spaced from the indicia panel;
- a light source on the printed circuit board positioned to pass light through the indicia panel and through the opening on the electrochromic mirror subassembly; and
- 10 a light seal between the printed circuit board and the indicia panel shaped to sealingly engage the printed circuit board and the indicia panel to prevent light leakage around the indicia panel.

41. The mirror defined in claim 40, including a light seal attached to indicia panel and that extends toward the light source and that is configured to reduce stray light from the

15 light source.

42. The mirror defined in claim 41, wherein the light seal comprises a resilient compressible foam.

20 43. The mirror defined in claim 42, wherein the first-mentioned light source is mounted on the printed circuit board and further including additional light sources mounted on the printed circuit board, and wherein the indicia panel includes multiple windows generally aligned with the first-mentioned and additional light sources, the light seal including windows that generally align with the first-mentioned and additional light sources and

25 further that align with predetermined areas on the indicia panel.

44. A mirror comprising:

- an electrochromic mirror subassembly including front and rear transparent elements, a layer of electrochromic material associated with the front and rear transparent elements, and a reflective layer;
- 30 an indicia panel attached to a rear surface of the mirror subassembly;
- a printed circuit board spaced from the indicia panel;

a light source on the printed circuit board positioned to pass light through the indicia panel and the electrochromic mirror subassembly;

a light seal shaped to sealingly engage the printed circuit board and the indicia panel to prevent light leakage laterally from the indicia panel; and

5 a housing and a bezel shaped to receive the mirror subassembly and, when assembled, shaped to compress together the mirror subassembly, the indicia panel, the printed circuit board, and the light seal.

10 45. The mirror defined in claim 44, wherein the indicia panel forms a visual display having at least two separated areas of information, and wherein the light seal includes sections preventing light leakage between the at least two separated areas.

46. The mirror defined in claim 45, wherein the light seal has marginal material that extends completely around at least one of the separated areas.

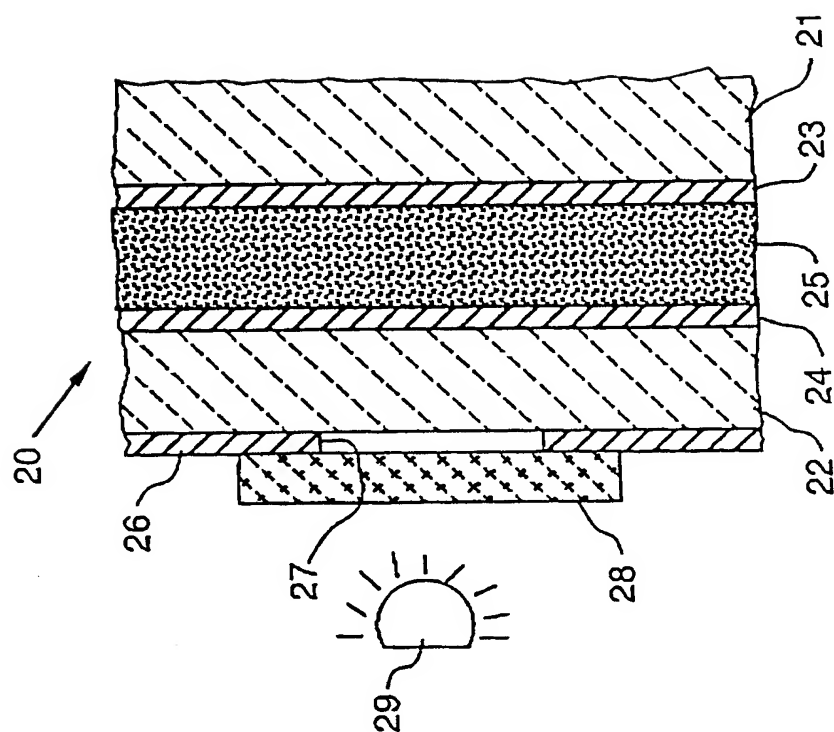


FIG. 3

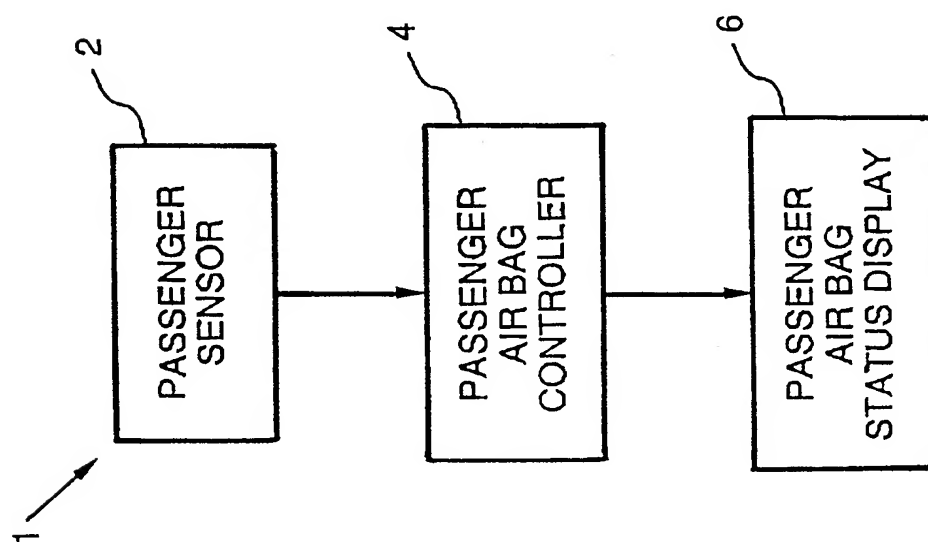


FIG. 1

2/15

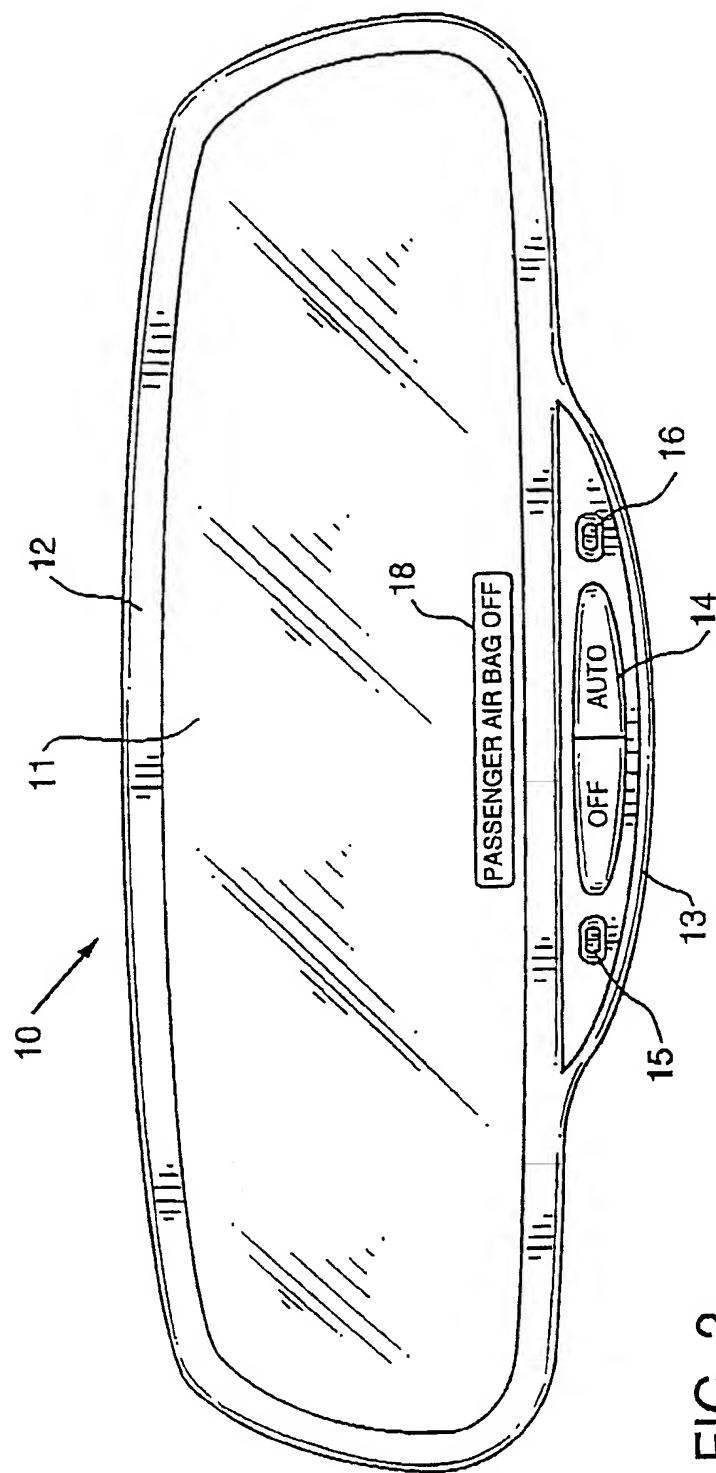
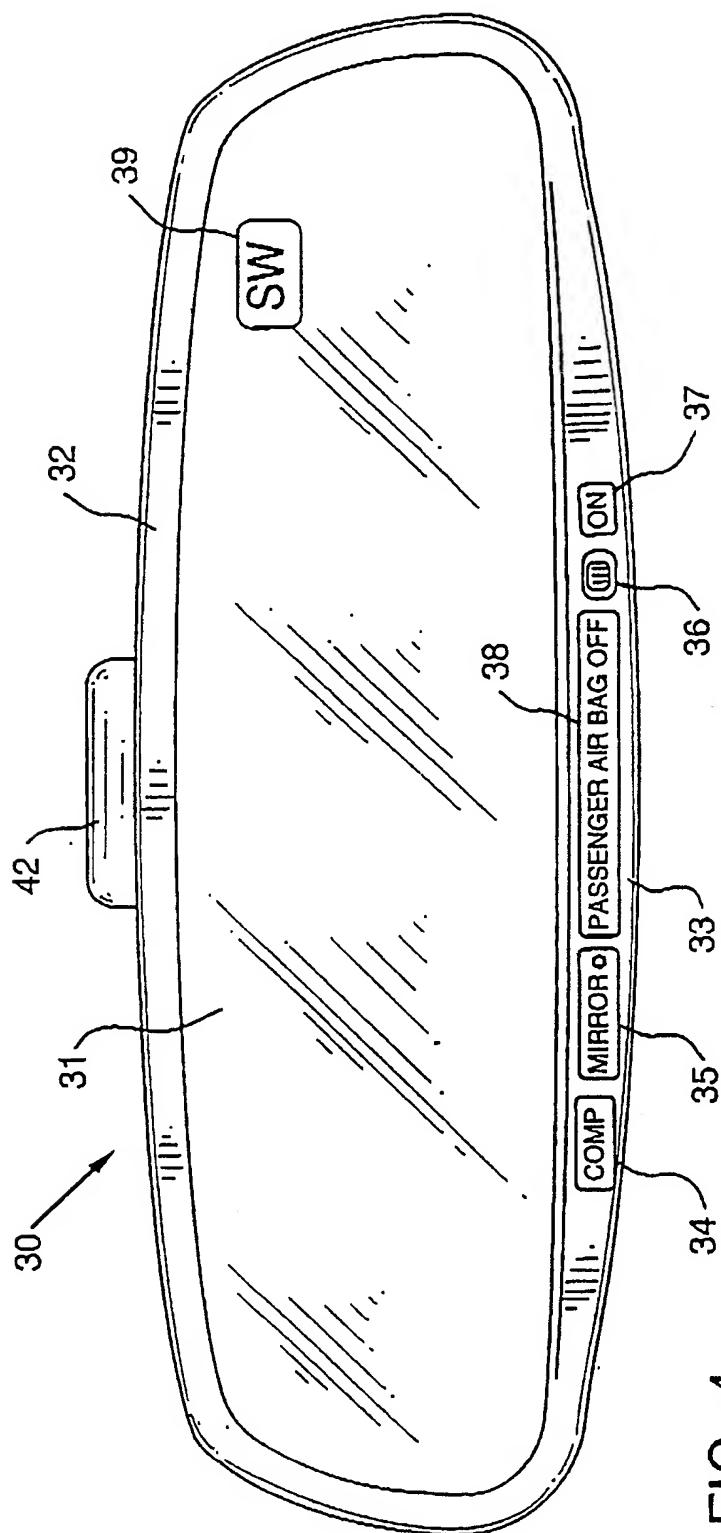


FIG. 2

3/15



4/15

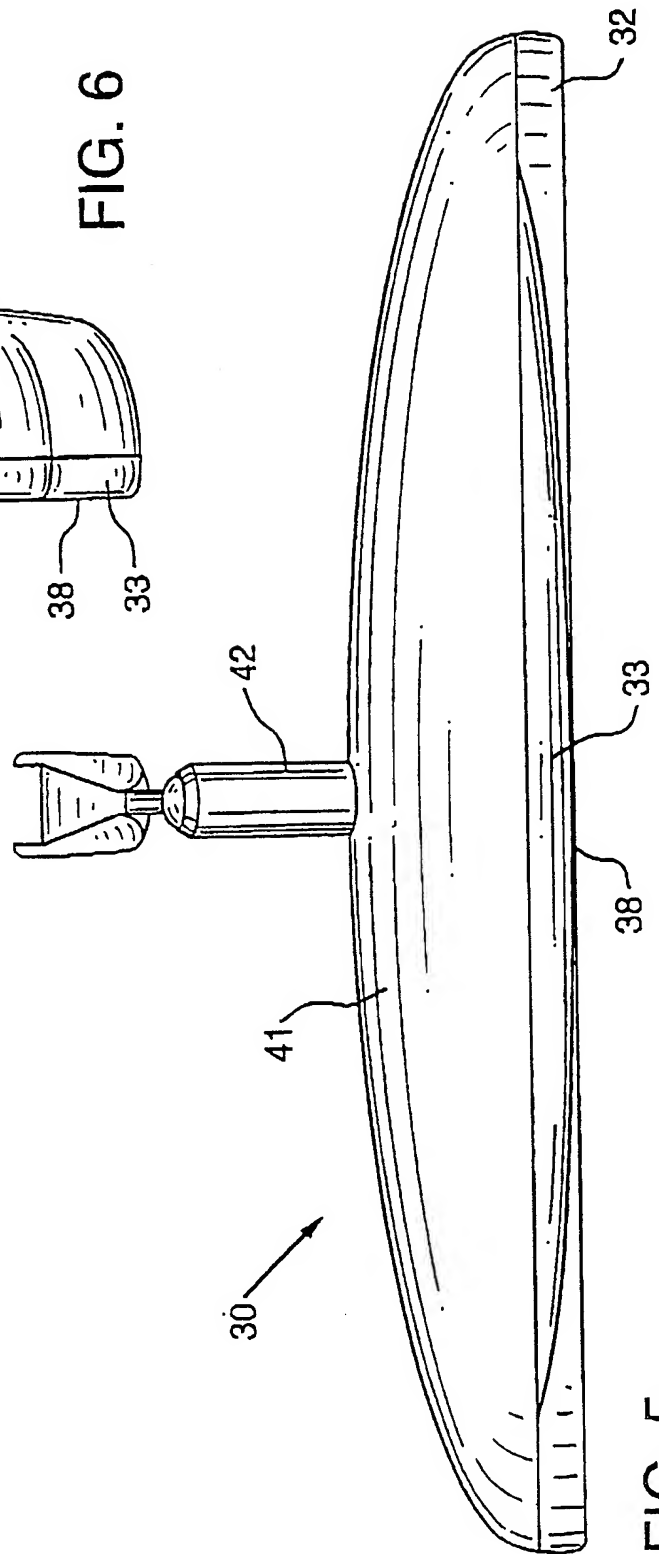
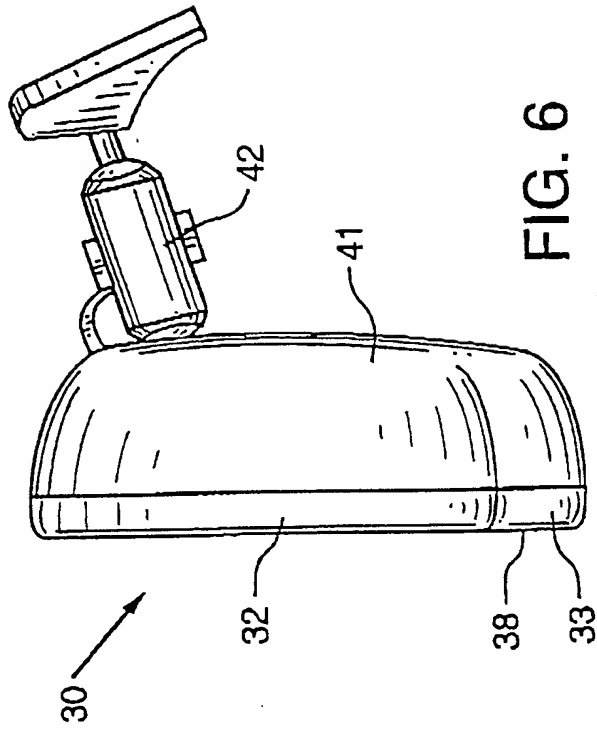


FIG. 5

FIG. 6

5/15

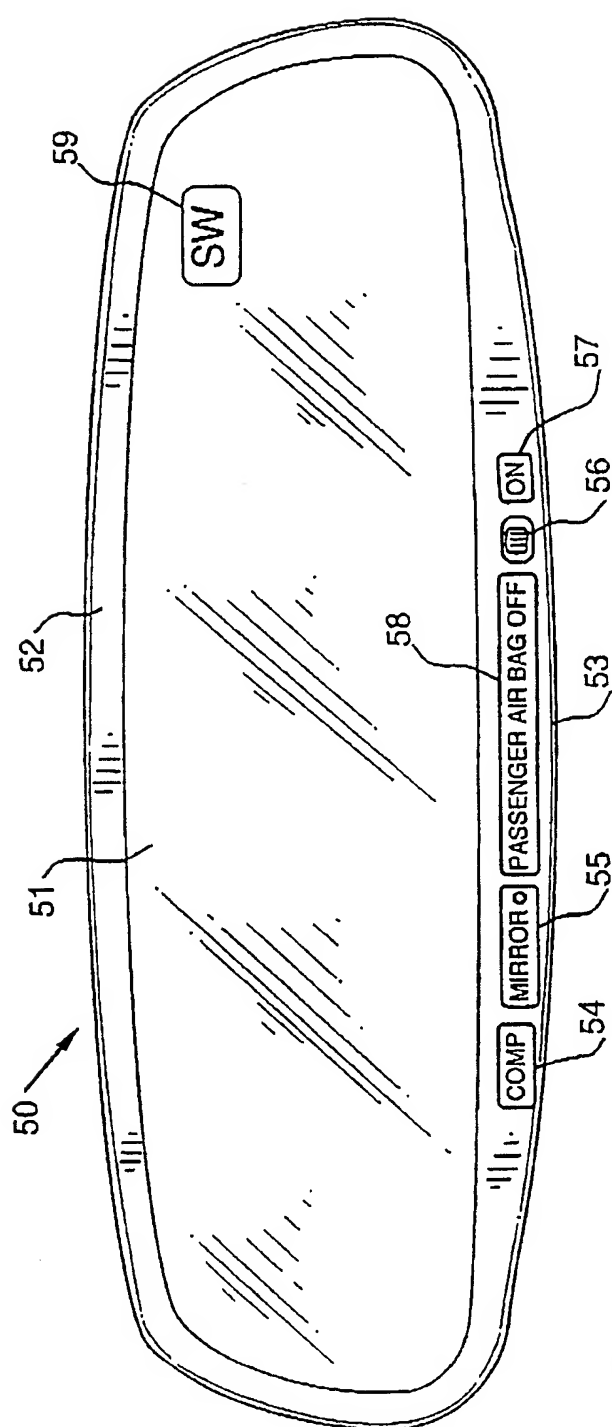


FIG. 7

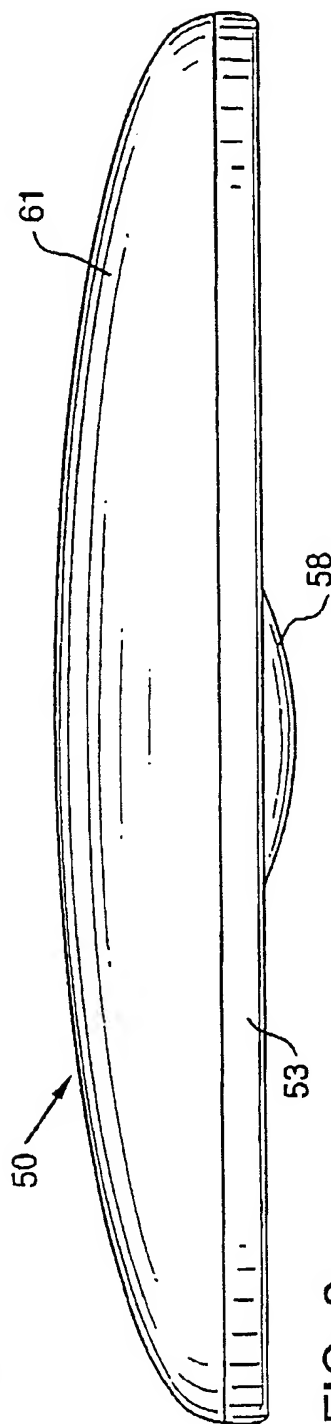


FIG. 8

6/15

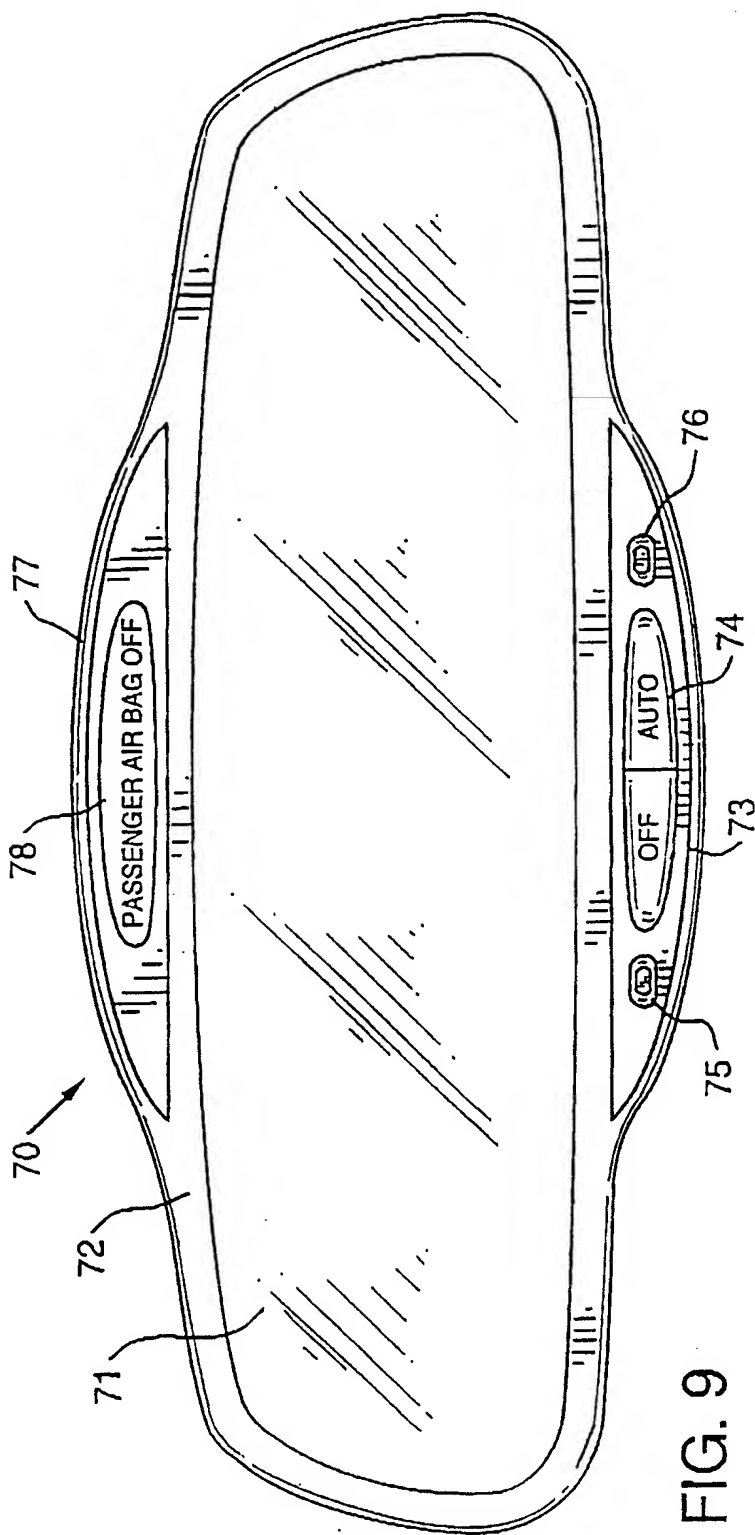


FIG. 9

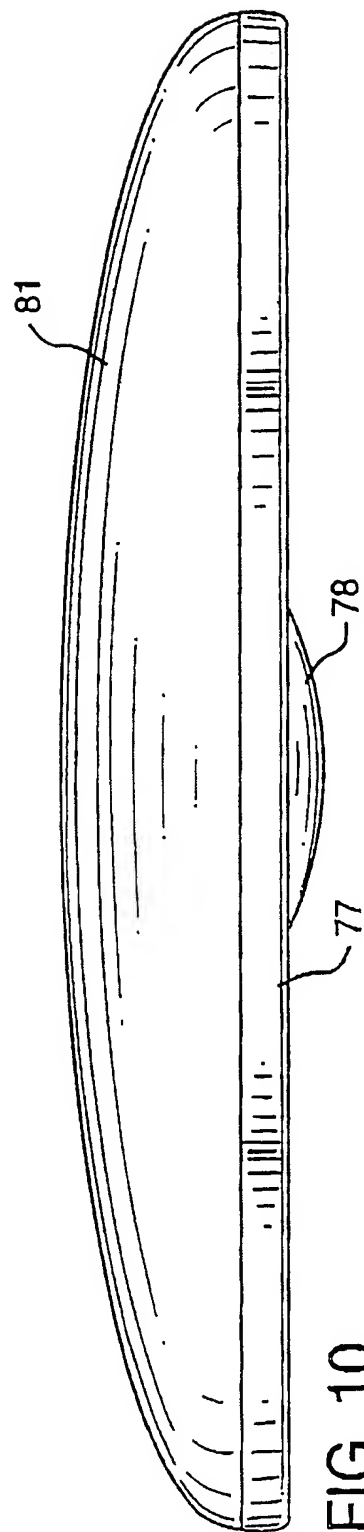


FIG. 10

7/15

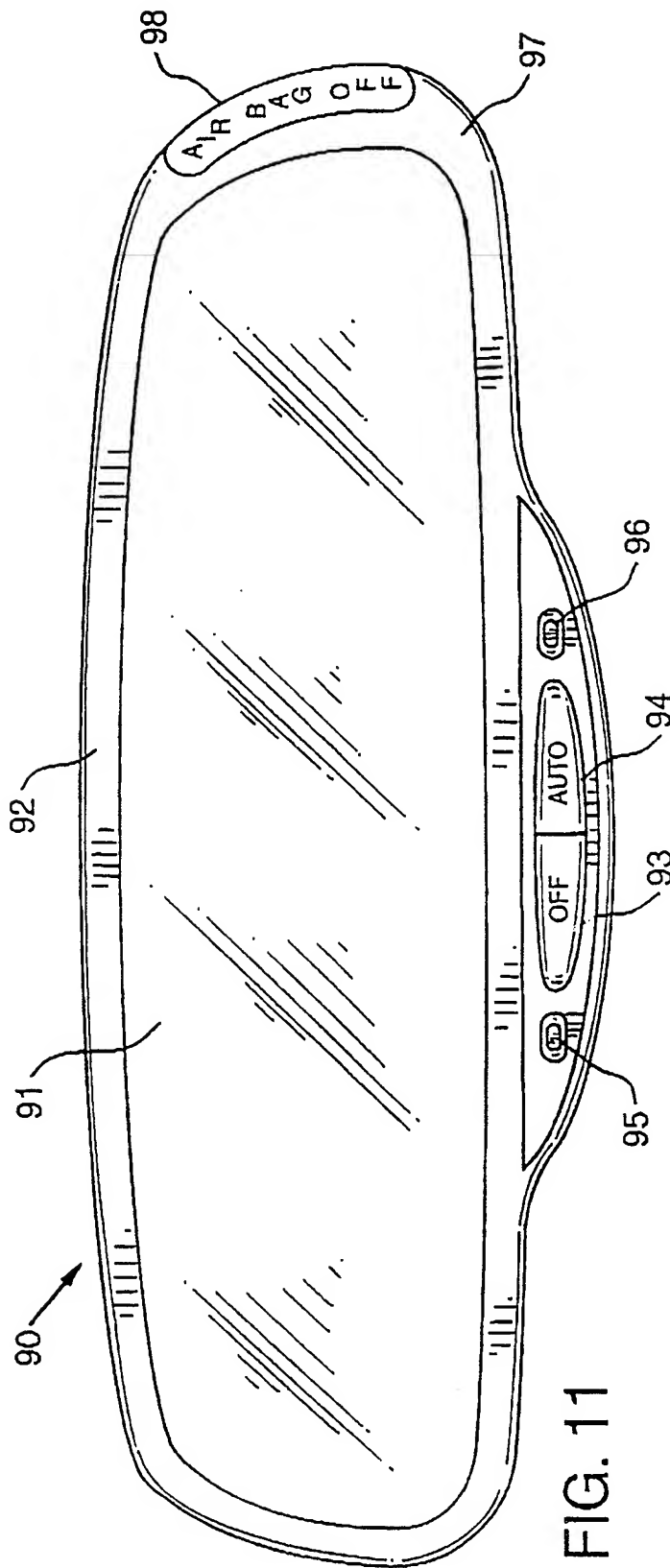


FIG. 11

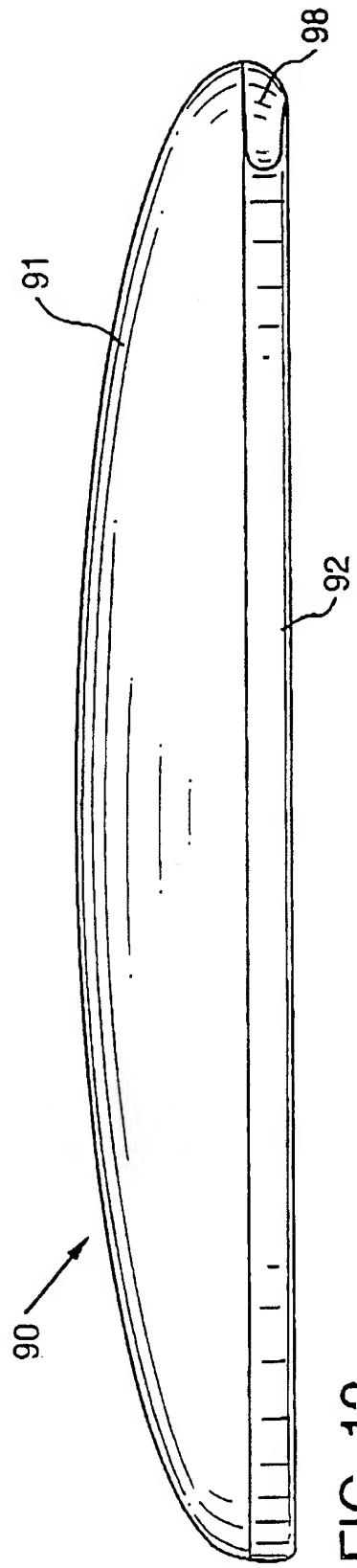


FIG. 12

8/15

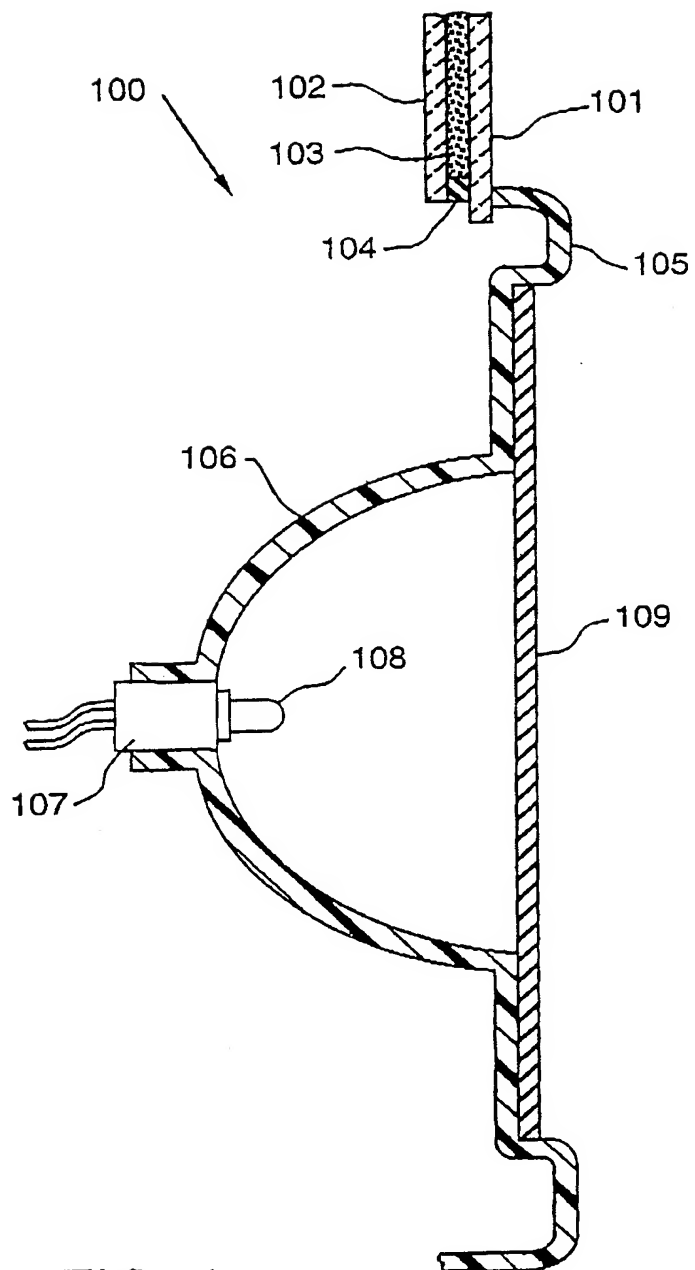


FIG. 13

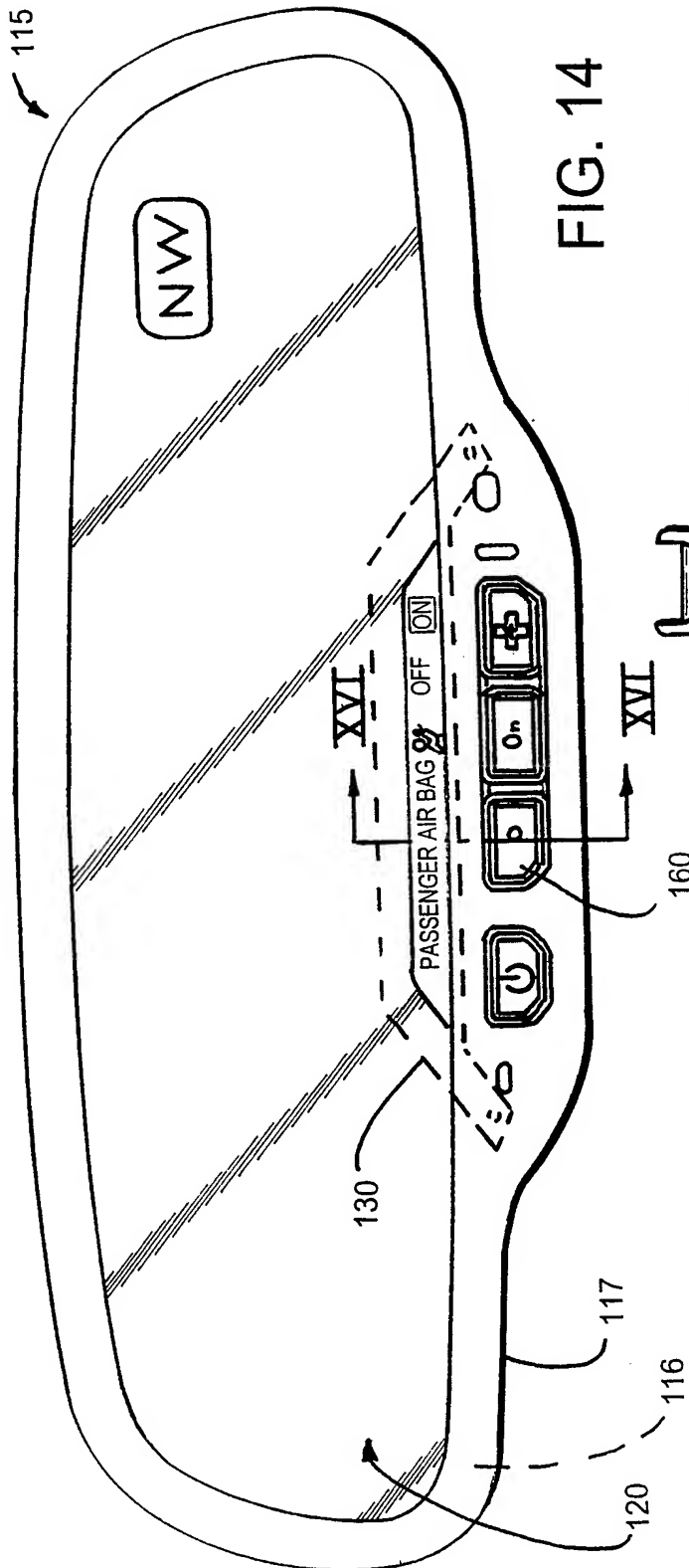


FIG. 14

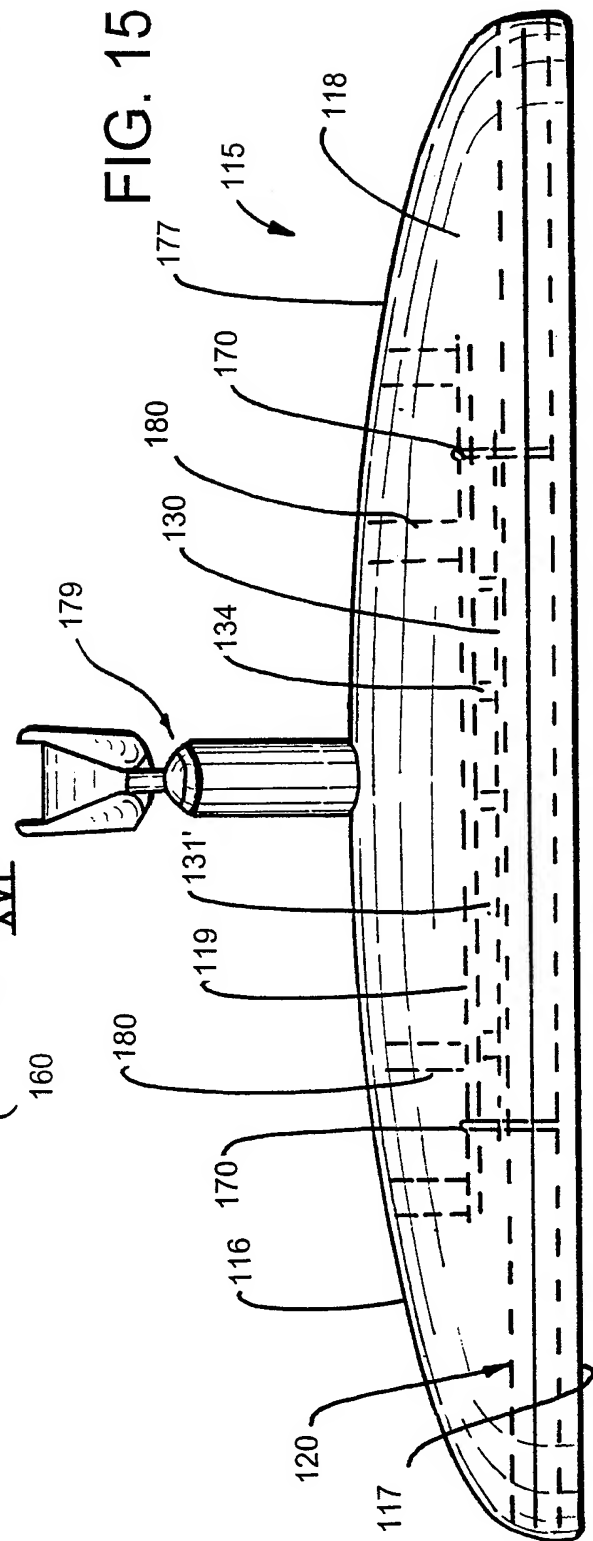
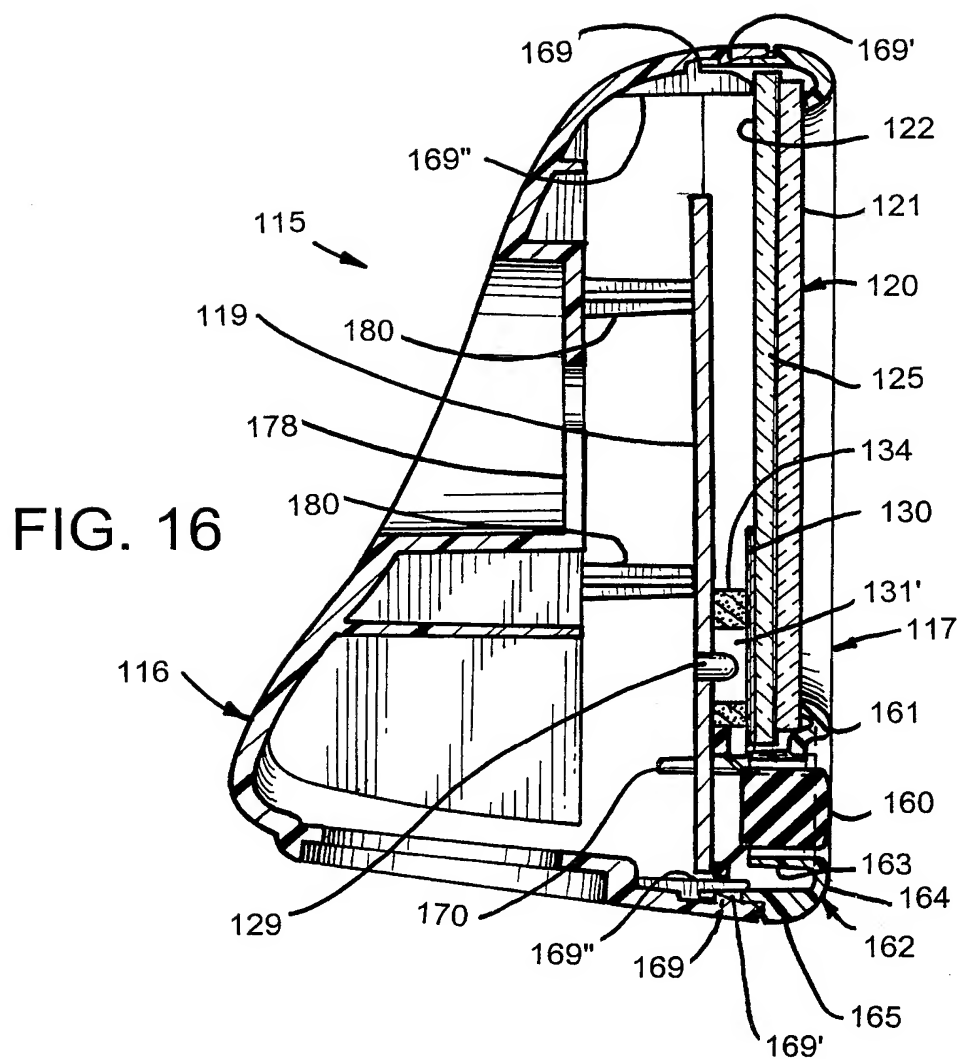
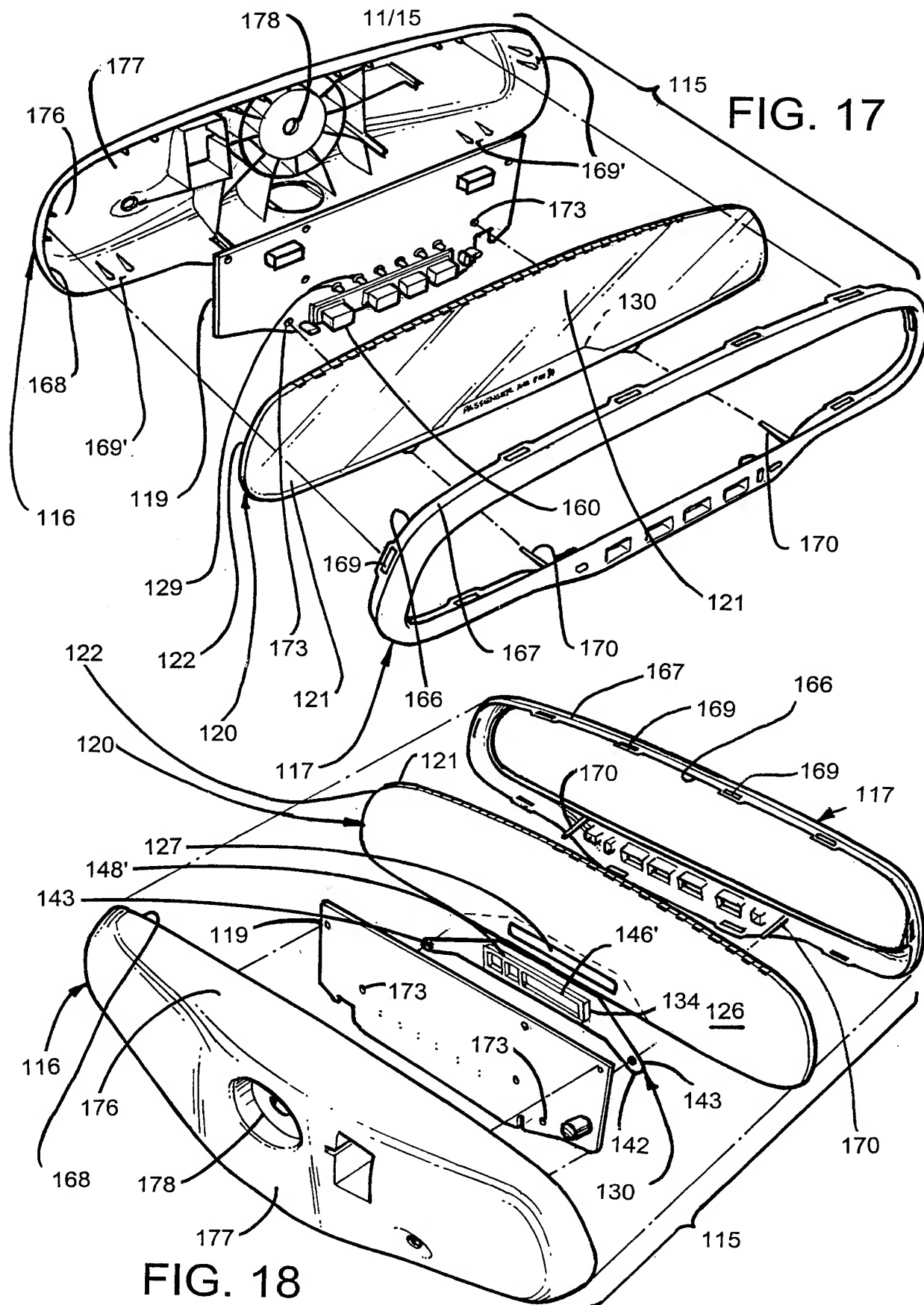


FIG. 15

10/15





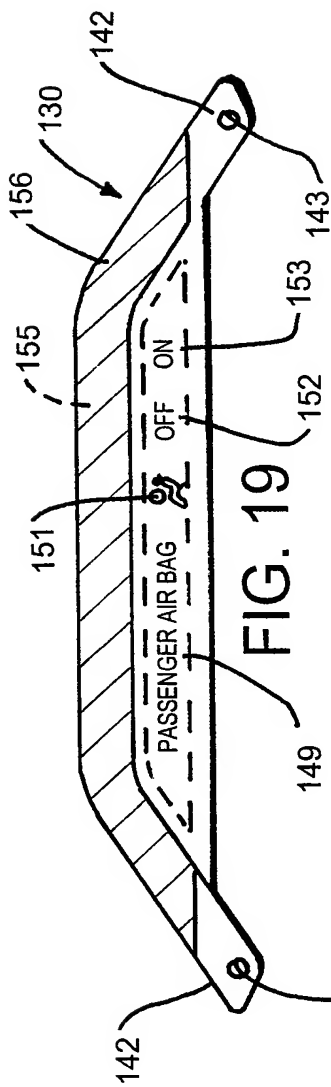


FIG. 19

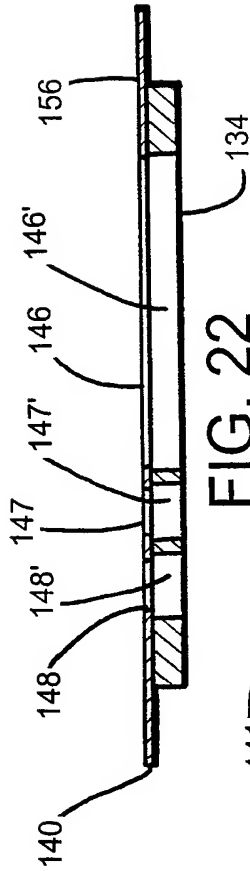


FIG. 21

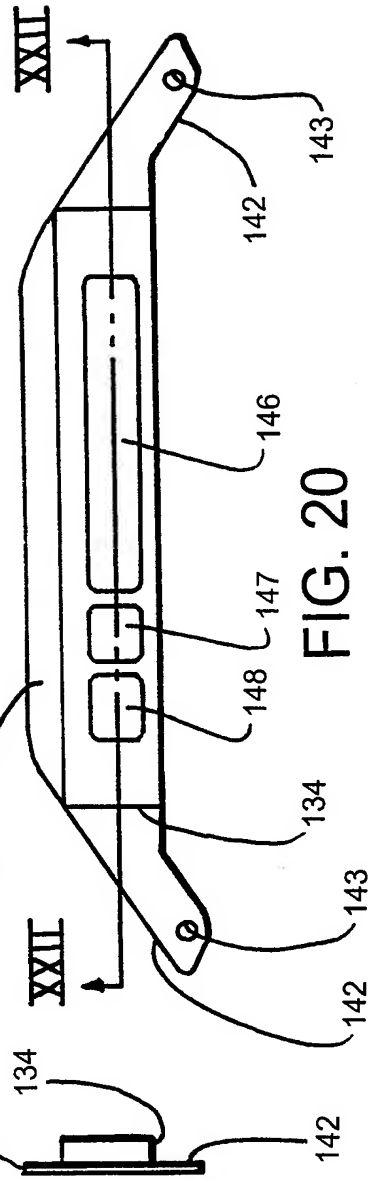


FIG. 20

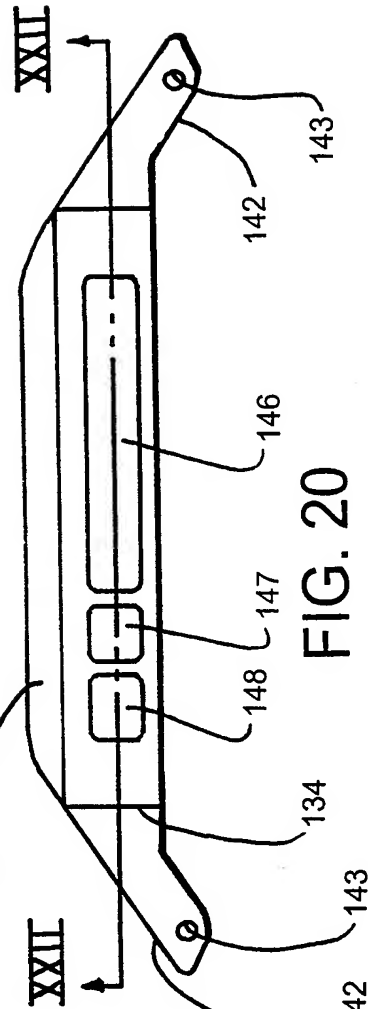
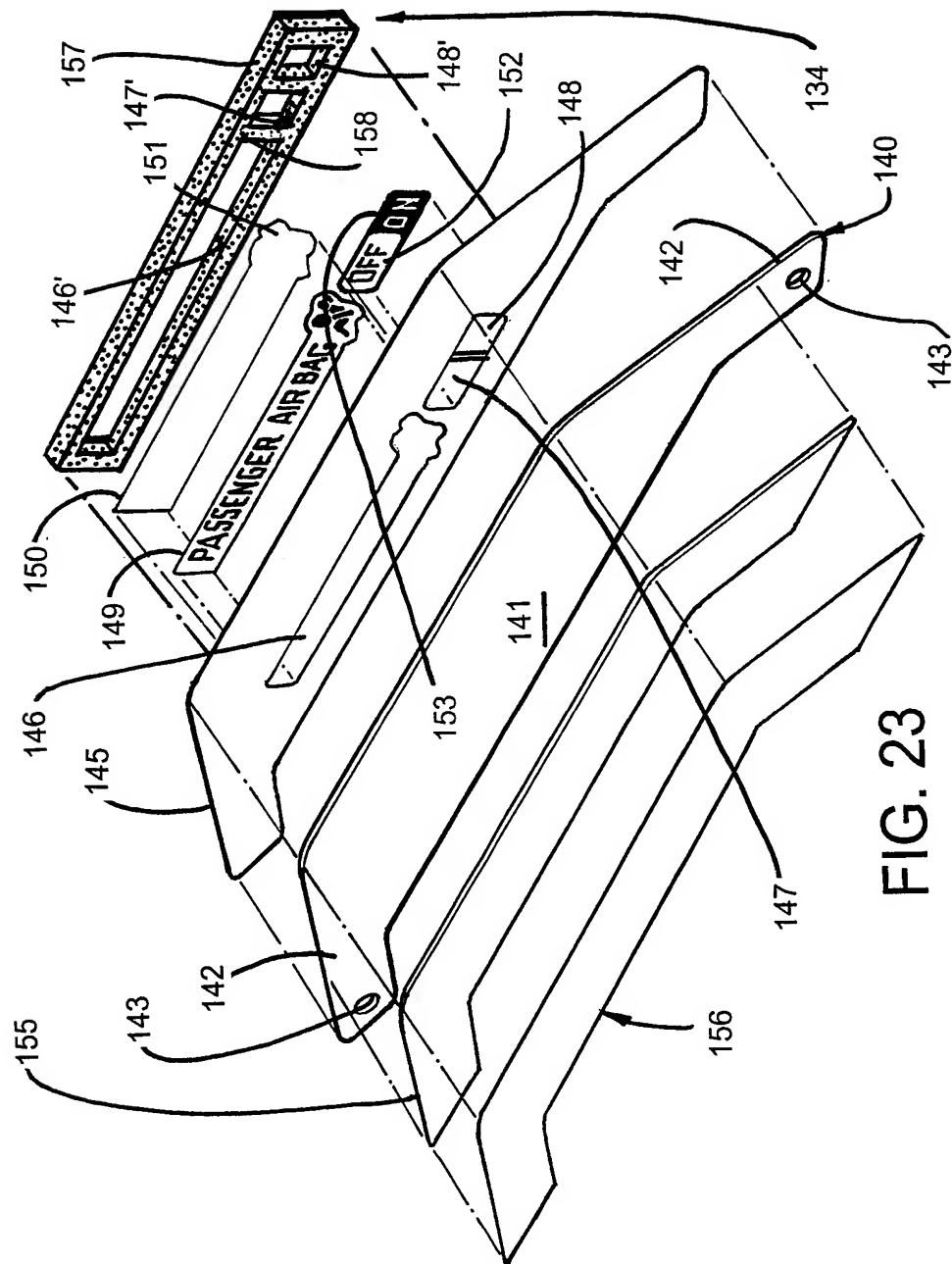


FIG. 22

13/15



14/15

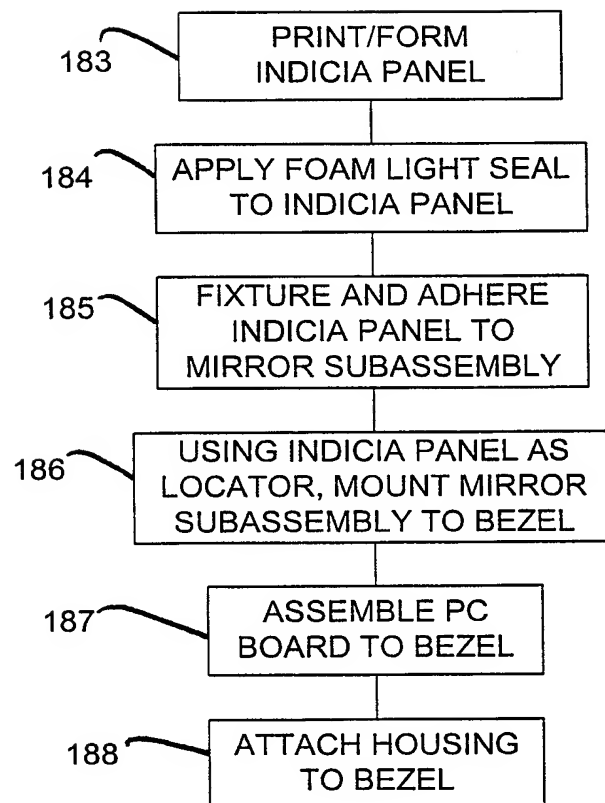
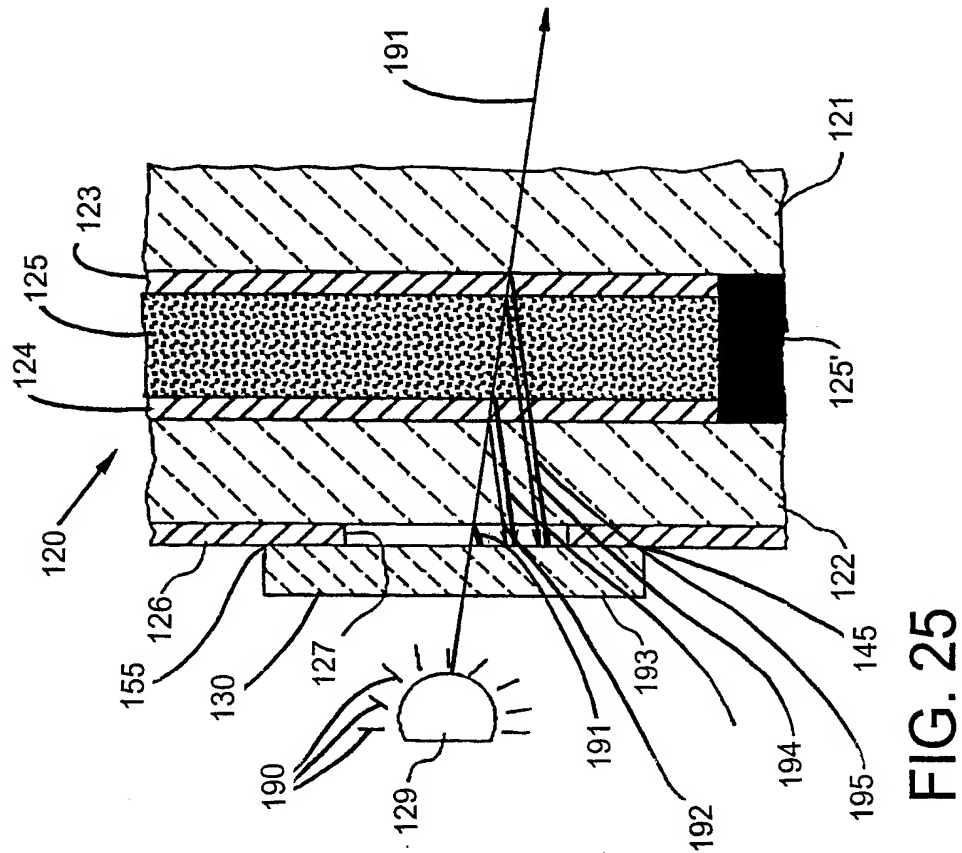
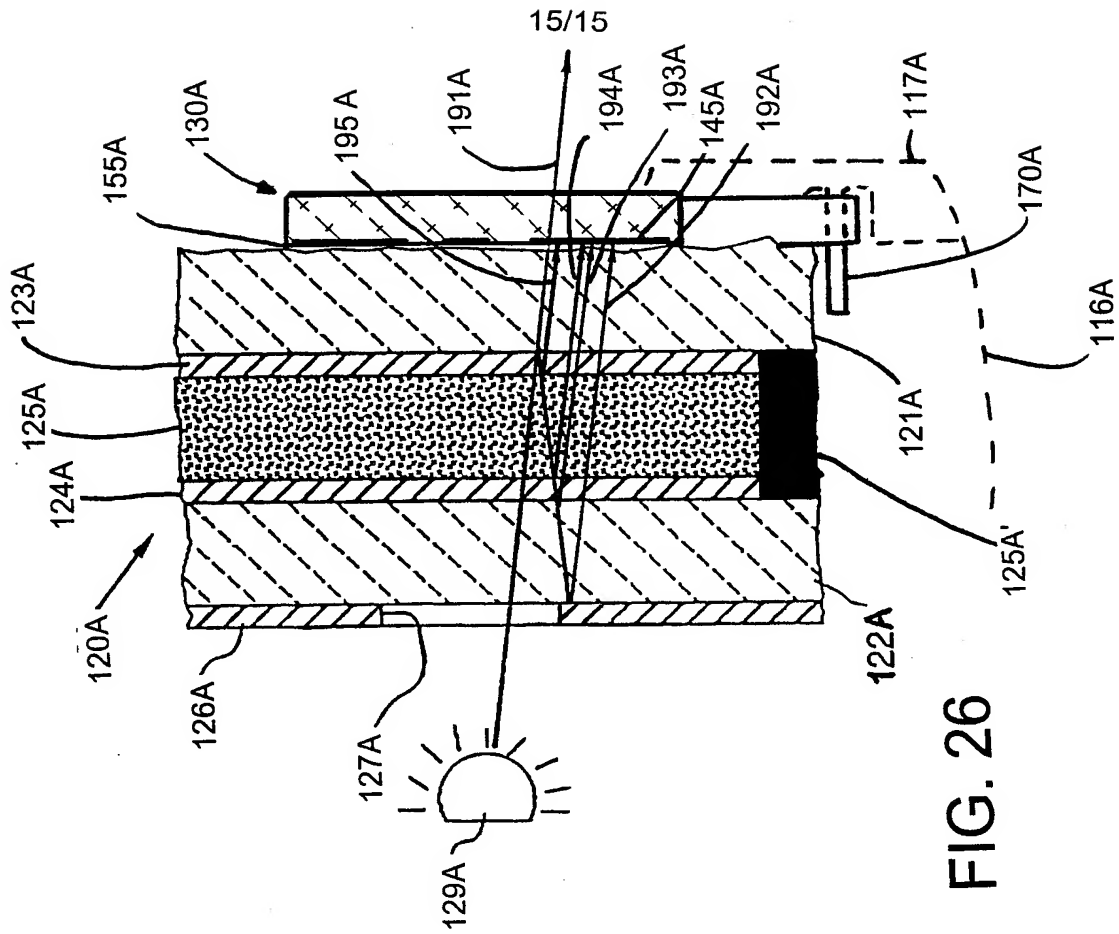


FIG. 24



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/22938

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : G02B 7/182

US CL : 359/879

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 359/879, 838, 839, 603

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

BRS (EAST)

search terms: bezel, seal, rearview mirror, rear view mirror, mirror, display, indicator

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y ----- A	US 5,724,187 A (Varaprasad et al) 03 March 1998, (03.03.98), Figure 9.	1-7, 9-21, 23-24, 26-39 ----- 8, 22, 25, 40-46
Y ----- A	US 4,630,904 (Pastore) 23 December 1986, (23.12.86), Figure 2.	1-7, 9-21, 23-24, 26-39 ----- 8, 22, 25, 40-46
Y	US 5,661,455 (Van Lente et al) 26 August 1997, (26.08.97), Figure 4.	13-21, 30-39
Y	US 5,572,354 (Desmond et al) 05 November 1996, (05.11.96), Figure 8.	20, 21



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
A document defining the general state of the art which is not considered to be of particular relevance	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
E earlier document published on or after the international filing date	*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	* & * document member of the same patent family
O document referring to an oral disclosure, use, exhibition or other means	
P document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

10 DECEMBER 1999

Date of mailing of the international search report

03 FEB 2000

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized officer

JENNIFER WINSTEDT

Telephone No. (703) 305-0577

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/22938

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,649,756 (Adams et al) 22 July 1997, (22.07.97), lines 14-17, Abstract.	23, 24, 28, 29
Y	WO 97/48134 (Turnbull et al) 18 December 1997, (18.12.97), Figure 1.	27
A	US 5,285,060 (Larson et al) 08 February 1994, (08.02.94), whole document.	1-46